COUNTY OF WESTCHESTER
NEW YORK

DIVISION OF ENGINEERING

ADDENDUM NO. 1

CONTRACT NO. 22-522

DOMESTIC WATER SYSTEM IMPROVEMENTS
WESTCHESTER COUNTY AIRPORT
TOWNS OF HARRISON AND NORTH CASTLE AND
VILLAGE OF RYE BROOK, NEW YORK

The attention of the bidder is directed to the following changes, additions, and/or substitutions affecting the above referenced contract.

I. RE: MANDATORY PRE-BID MEETING

Mandatory Pre-Bid Meeting Sign-In Sheet And Handout Attached Hereto

II. RE: THE SPECIFICATIONS

DELETE: TECHNICAL SPECIFICATIONS TOC in its entirety

INSERT: TECHNICAL SPECIFICATIONS TOC (Attached Hereto)

DELETE: TECHNICAL SPECIFICATIONS in its entirety

INSERT: TECHNICAL SPECIFICATIONS (Attached Hereto)

ALL PROVISIONS OF THE CONTRACT NOT AFFECTED BY THE FOREGOING SHALL REMAIN IN FULL FORCE AND EFFECT.

COUNTY OF WESTCHESTER
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

By: Hugh J. Greechan Jr., P.E.
Commissioner

Dated: Thursday, December 22, 2022
WHITE PLAINS, NEW YORK

CONSULTING ENGINEERS

Principals
Patrick F. Lynch, P.E.
Steven Abbattista, P.E.
James F. Dolan, P.E.
John Torre, P.E.
Jill Walsh, P.E.
Matthew Amicone, P.E.

Westchester
50 Broadway
Hawthorne, NY
10532
914-747-2800

New York City
8 West 38th Street
Suite 501
New York, NY
10018
646-849-4110

olace.com

SIGN-IN SHEET

Project: Westchester County Airport – Domestic Water System Improvements

Contract No.: 22-522

Date of Meeting: December 19, 2022

Location of Meeting: Westchester County Airport – Main Terminal Building 2nd Floor Operations Conference Room

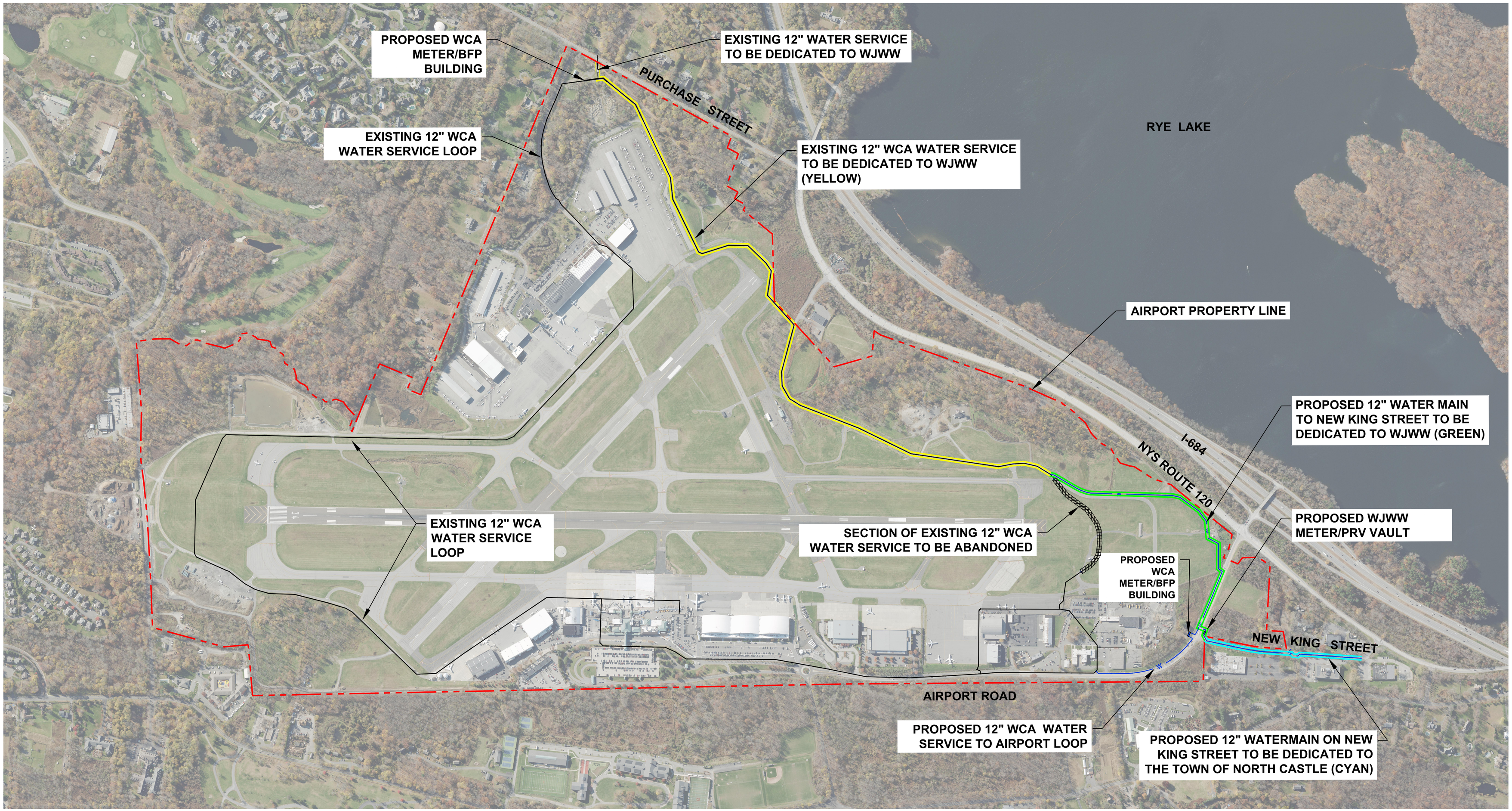
Purpose of Meeting: Pre-Bid Mandatory Site Walkthrough

Name	Company	Email	Phone
ANDREW GRANDI	D & B	AGRANDI@DB-PMI.COM	914-223-1803
Christine DiSisto	OLA	CDISISTO@olace.com	914-879-2057
Mike Baker	Gianfia Corp	estimating@gianfiacorp.com	914-358-4601
Tony Silva	ELG INDUSTRIES INC.	TSilva@ELGINDUSTRIES.com	914-654-1040
KARINA GASPAR	JR CRUZ	karinaGG@JRcruz.com	(732) 290 0700
James Benson	JRCRUZ	jbenson@jrcruz.com	732-290-0700
JOE BERGEY	LAURA LI	jbergey@lauralinds.com	631 820 1193
Max Pugni	R Pugni & SONS	pugnimax@gmail.com	914-406-3918
Vic Serricchio	NORTHBROOK	PATD@northbrookcompanies.com	(CELL) 737-4404 EXT 1229
Andrew Ciralli	Morano Brothers Corp	aciralli@moranobros.com	914-788-8460
Rick Hopkins	Morano Brothers Corp	chopkins@moranobros.com	914 788 8460
Vito Bilotta	Montesano Bros. Inc	VBILOTTA@MONTESANO BROS.COM	914-235-4800

SEE PAGE 2

Name	Company	Email	Phone
Manoj Garimella	Ocsindustries, Inc	mgarimella@ocsindustries.com	845-479-2490
Ahsam Khalid	Inter contracting corp.	akhalid@intercontractingcorp.com	347-901-6103
Andy Urgiles	Triumph Construction Corp.	aurgiles@triumphconstructionny.com	347-818-3942
MANNY FOTO	ECCO III ENTERPRISES	mfoto@eccoiii.com	914-963-3600
GARY POGNI	BRADHURST SITE CONST.	mpbradhurst@optonline.net	914 592-8060
Elaine Krauss	WCDPW&T	efs3@westchestergov.com	914-995-2204
Brian Hegt	"	BDHV@westchestergov.com	995-2552
JOSEPH BERGEY	LAURA LI IND.	jbergey@lauraliindustries.com	631 820 1193

NORTH



GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)
1 inch = 400 ft.

NOT FOR CONSTRUCTION

D&B ENGINEERS AND ARCHITECTS, P.C.
4 WEST RED OAK LANE
WHITE PLAINS, NY,
10604
(914)467-5300

CONSULTANT SEAL

IN CHARGE OF
CHECKED BY
MADE BY

REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION

☐ AS BUILT – CHANGES AS NOTED
☐ AS BUILT – NO CHANGES

CONTRACTOR
NAME
SIGNATURE
TITLE DATE

PROJECT COORDINATOR
NAME
SIGNATURE
TITLE DATE

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
DIVISION OF ENGINEERING

NEW KING STREET WATER MAIN EXTENSION
TOWN OF HARRISON AND NORTH CASTLE AND VILLAGE OF RYE BROOKE, NEW YORK
PRELIMINARY WATER MAIN LAYOUT

CONCEPTUAL WATER MAIN EXTENSION

CONTRACT NUMBER | SHEET NUMBER
SHEET NO. OF
SCALE:
DATE: MAY 2020
DPW FILE NO. | REV. NO.

DOMESTIC WATER LINE IMPROVEMENTS
WESTCHESTER COUNTY AIRPORT

CONTRACT 22-522

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

NO TEXT ON THIS PAGE

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Work to be performed under this Contract and in accordance with these Specifications consists of, but is not limited to, furnishing of all equipment, superintendents, labor, skill, material and all other items necessary for the project. The Contractor shall perform all Work required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

B. The Contract consists of Base Bid Items A through GG. The principal features of the Base Bid Items to be performed include but are not limited to:

1. Bid Item A – Soil Erosion and Sediment Control
2. Bid Item B – Traffic Control
3. Bid Item C – Con Edison Fee Allowance
4. Bid Item D - Cement Lined Ductile Iron Water Main Pipe - 12" diameter, Furnished and Installed
5. Bid Item E - Cement Lined Ductile Iron Water Main Pipe - 10" diameter, Furnished and Installed
6. Bid Item F - Cement Lined Ductile Iron Water Main Pipe - 6" diameter, Furnished and Installed
7. Bid Item G - Cement Lined Ductile Iron Water Main Pipe - 4" diameter, Furnished and Installed
8. Bid Item H - Miscellaneous Water Main Fittings (elbows, bends, fittings and tees), Furnished and Installed
9. Bid Item I - Inline Gate Valve - 12", Furnished and Installed
10. Bid Item J - Inline Gate Valve - 10", Furnished and Installed
11. Bid Item K - Inline Gate Valve - 6", Furnished and Installed
12. Bid Item L - Inline Gate Valve - 4", Furnished and Installed
13. Bid Item M - Insertion Valve (Live Shut Down) - 12", Furnished and Installed

14. Bid Item N - Fire Hydrant Assembly, Furnished and Installed

15. Bid Item O – Rock Removal and Disposal

16. Bid Item P – Temporary Asphalt Pavement

17. Bid Item Q - Asphalt Top Course, Furnished and Placed

18. Bid Item R - Asphalt Binder Course, Furnished and Placed

19. Bid Item S – Pavement Sawcutting

20. Bid Item T - Sub-base Course, Furnished and Placed

21. Bid Item U – Select Fill, Furnished and Placed

22. Bid Item V – Bedding Sand, Furnished and Placed

23. Bid Item W - Exploratory Excavation (Test Pits)

24. Bid Item X – Controlled Low Strength Material, Furnished and Placed

25. Bid Item Y – Waste Transportation and Disposal

26. Bid Item Z – Crushed Stone, Furnished and Placed

27. Bid Item AA – Topsoil, Furnished and Placed

28. Bid Item BB – Grass Seed, Furnished and Placed

29. Bid Item CC – Culvert Replacement

30. Bid Item DD – Meter Vault, Furnished and Installed

31. Bid Item EE – Tower Road Backflow Preventer Building

32. Bid Item FF – Airport Road Backflow Preventer Building

33. Bid Item GG – Groundwater Treatment and Disposal

1.2 GENERAL

A. The Instructions for Bidders, General Conditions and Division 1 of the Technical Specifications, shall apply equally to all Work under the Contract for this Project.

B. Where the words "Contract" and "Contractor" are used in Sections of Division 1, they shall apply equally to all parties entering into agreements with the Owner to perform Work specified herein and to all Contracts derived from said agreements.

C. Where the word "Owner" is used in these Specifications, it shall refer to the Westchester County Department of Public Works and Transportation.

1.3 CONTRACT DOCUMENTS

A. The Work to be done is shown on the set of Contract Drawings entitled Domestic Water Line Improvements, Westchester County Airport, Towns of Harrison and North Castle, New York.

1.4 GENERAL ARRANGEMENT

A. The Contract Drawings indicate the extent and general arrangement of the Work. The specific equipment proposed for use by the Contractor on the Project may require changes in the construction detailed on the Contract Drawings, and all such changes shall be performed in accordance with the requirements of the Contract Documents and shall be made without additional cost to the Owner and shall include the increase in costs of the other Contracts.

1.5 TIME OF WORK

A. Overtime work shall conform to the requirements of Division 1, Supplementary Conditions, shall be considered as normal procedure under this Contract, and the Contractor shall make no claims for extra compensation as a result thereof.

B. Unless otherwise specifically permitted, all work that would be subject to damage shall be stopped during inclement, stormy or freezing weather. Only such work as will not suffer injury to workmanship or materials will be permitted. The Contractor shall carefully protect his Work against damage or injury from the weather, and when work is permitted during freezing weather shall provide and maintain approved facilities for heating the materials and for protecting the finished Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

PART 4 MEASUREMENT AND PAYMENT (NOT USED)

++ END OF SECTION ++

NO TEXT ON THIS PAGE

SECTION 01 19 00

MISCELLANEOUS PROVISIONS

PART 1 - GENERAL

1.1 PROVISIONS DEEMED INSERTED

A. Each and every provision required by law to be inserted in the Contract Documents shall be read and enforced as though it were included herein and in the event any such provision is not inserted, or is not correctly inserted, then, upon the application of either party, the Contract Documents shall forth with be physically amended to make insertion or correction.

1.2 RIGHT TO USE WORK

A. The Owner may enter upon and use the whole or any portion of the work which may be in condition to use at any time previous to its final acceptance by the Owner. Such use shall not constitute or be evidence of acceptance by the Owner or Engineer of the whole or any part of the material furnished or work performed under the Contract.

1.3 PATTERN OF WORK

A. The Contractor is directed to work in such a manner so as to minimize the impact of the construction work on the operations of the Westchester County Airport.

1.4 APPROVED EQUIVALENT ARTICLES, MATERIALS AND EQUIPMENT

A. It is the intent of the specifications to describe definitively and fully the character of materials and workmanship furnished, and to require first class work and materials in all particulars. The terms “equal” or “approved equal”, as used in these specifications shall mean approved by the Engineer in writing.

1.5 PENAL CODE

A. Section 1918 of the Penal Law, as amended, provides that no person shall discharge explosives in the ground, nor shall any person other than a state or county employee regularly engaged in the maintenance and repair thereof, excavate in any existing street, highway, or public place, unless notice thereof in writing shall have been given at least 72 hours in advance to the person, corporation or municipality engaged in the distribution of gas in such territory. The person having direction or control of such work shall give such notice and further he shall ascertain whether there is within 100 feet in such street, highway or public place, or in case of a proposed discharge of explosive within a radius of 200 feet of such discharge, any pipe of any other person, corporation or

municipality conveying combustible gas, and if there be such pipe he shall also give such notice to any such person, corporation or municipality. Provided, however, that in any emergency involving danger to life, health or property it shall be lawful to excavate without using explosives if the notices prescribed herein are given as soon as reasonably possible, and to discharge explosives to protect a person or persons from an immediate and substantial danger of death or serious personal injury if such notices are given before any such discharge is undertaken.

B. Any such work shall be performed in such manner as to avoid damage to any pipe conveying combustible gas. Any violation of the provisions of this Section shall be a misdemeanor.

1.6 COMPRESSED GAS

A. Where compressed gas of any type is used for any purpose, it shall be contained in cylinders complying with ICC regulations as to manufacturing, filling, marking, testing, tagging, valving and shipping. Gases of different types shall not be stored together except when in use and when such proximity is required.

B. All gas cylinders shall be stored in sheds constructed of non-combustible materials. Sheds shall be well ventilated and without electric lights or fixtures and shall be located as far from other buildings as is practicable. All gas cylinders not in actual use, or in proposed immediate use, shall be removed from the building under construction or reconstruction. Empty gas cylinders shall be removed prior to bringing in a replacement cylinder. Cylinders shall at all times be supported and braced in an upright position. When not in use the protective cap shall be screwed over the valve.

C. All persons required to handle gas cylinders or to act as temporary firemen (firewatchers) shall be able to read, write and understand the English language; they shall be also be required by the Contractor to read Part 3 of Pamphlet P-1 “Safe Handling of Compressed Gases” published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 11036, and available to the Contractor for 50 cents per copy.

D. Where L-P Gas is required for Temporary Heat (including Construction Heat), the number of cylinders within the structure or building shall be limited to the least amount required, in general, one cylinder per heater. Cylinders and heaters shall be connected with two braid neoprene hose fitted at each end with threaded unions and capable of withstanding a pressure of 250 psi. The length of hose shall not exceed 30 feet and shall be protected from mechanical injury, kinking and abrasion. Heaters shall be not less than 6 feet from any cylinder and not less than 10 feet from any tarpaulin or other type of closure. All tarpaulins and other type closures shall be secured so as not to be blown loose. All debris and rubbish shall be removed as directed to prevent fire hazards.

E. Where local ordinances are in effect regarding gas cylinders,(their use, storage, appurtenances, and handling), such ordinances shall supplement the requirements of this specification.

F. L-P gas heating will not be permitted in enclosed area below grade.

G. Any cylinder not having the proper ICC markings or reinspection marking, or any cylinder which, in the opinion of the Engineer, fails to meet the requirements of the "Standards for Visual Inspection of Compressed Gas Cylinders" of the Compressed Gas Association, Inc., shall be returned to the supplier. Any cylinder which develops a leak shall be isolated immediately away from any building and the supplier shall be immediately notified; such other precautions as may be required to prevent damage or injury shall also be taken by the Contractor.

1.7 LEAVES AND SNOW REMOVAL

A. The Contractor shall remove leaves and snow during construction as required and as often as required to complete his work.

1.8 QUANTITIES

A. The total quantities of bid items are estimated only and actual quantities may be much greater or much less than those indicated.

B. The estimated quantities for all items may be subject to significant change due to budget constraints and/or field conditions at the time of construction. No additional compensation to the Contractor will be allowed for changes in the scope, extent or quantities of the work. For this and other reasons, unbalanced bids may be rejected if it is deemed to be in the best interest of the Owner to do so.

1.9 UNIT PRICES

A. Unit prices are deemed to be all inclusive of the necessary cost to complete the work and, unless specific authorization in writing from the Owner is received by the Contractor, no additional payment for extra items of work will be made. The determination of the Owner in this regard shall be final and binding.

1.10 CONTRACTOR SHALL NOT USE OWNER'S EQUIPMENT, TOOLS AND MANPOWER

A. The Contractor shall not be allowed to use Owner's tools, equipment and manpower in order to perform the work included in this Contract.

1.11 RESTORATION OF THE PREMISES

A. The Contractor shall be responsible for restoration of all damage to buildings, equipment, roadways, sidewalks, plantings, lawn and other physical features damaged through his operations. All damaged items shall be restored to their previous conditions at no additional cost to the Owner.

1.12 CONCRETE DEMOLITION AND REMOVAL

A. The method used for the demolition and removal of concrete will be subject to the approval of the Owner. The use of a ball operated from a crane will not be allowed. The use of a clamshell bucket for the removal of sidewalks, driveway aprons and curbs will not be allowed. All methods used must be such that the exact limits of the item to be removed can be accurately controlled. All work damaged or removed beyond the payment limit lines shall be restored at the Contractor's own expense, except where authorized by the Owner in writing. All broken concrete shall be removed from within the contract limits the same day that it is demolished.

1.13 MATERIAL DELIVERY TICKETS

A. All deliveries of materials to the job site shall be accompanied by an extra copy of the material delivery ticket, which shall be given to the Engineer as his copy. Refusal to provide such delivery ticket to the Engineer may result in rejection of the materials.

1.14 EMERGENCY TELEPHONE NUMBERS

A. In order to facilitate the contacting of Contractor's personnel in the event of emergency calls during those hours other than normal working hours, the following will be required:

1. Prior to the commencement of any work under this contract, the Contractor shall submit to the Owner the names of three (3) persons having authority to act for the Contractor along with their respective telephone numbers (office, home, beeper, cell phone, fax, etc.).

1.15 PROCEDURES

A. The Contractor shall temporarily fence all unattended excavations over 2 feet in depth with properly supported snow fence having a minimum height of 4 feet.

B. The drawings and specifications do not include all the necessary components for construction safety. It is the Contractor's responsibility to provide all construction safety measures at his own expense where not included as an integral part of a pay item.

C. The safety provisions in the specification are primarily to protect the Owner's property and the public against unsafe acts of the Contractor. The Occupational Safety and Health Act of 1970 requires that the employer... (1) shall furnish to each of his employees employment and place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees; (2) shall comply with the Occupational Safety and Health Standards promulgated under this Act.... The regulations in the Act may be more stringent than are required by the plans and/or specifications. The Contractor, however, must conform to the OSHA regulations and such conformance shall not be reason to demand additional payment or claim extra work. Sheeting shall conform strictly to the requirements of the OSHA regulations for Construction Subpart C, Excavation, Trenching and Shoring; 1926.650 General Protection Requirements; 1926.651 Specific Excavation Requirements; 1926.652 Specific Trenching Requirements; 1926.653 Definitions Applicable to this Subpart.

D. All work performed under this Contract shall comply with the requirements of the Industrial Code of the State of New York, Rule No. 23 and Rule No. 53, both as currently amended.

1.16 ACCESS TO PRIVATE PROPERTY

A. The Contractor shall at all times maintain access to all buildings in the area of the work.

1.17 ACCURACY OF PLANS AND SPECIFICATIONS

A. The detail plans and specifications for this Contract have been prepared with care and are intended to show as clearly as is practicable the work required to be done. The Contractor must realize, however, that the construction details cannot always be accurately anticipated and that in executing this work, field conditions may require reasonable modifications in the details of plans and quantities of work involved. Work under all items in the Contract must be carried out to meet these field conditions to the satisfaction of the Owner and in accordance with his instructions and the Contract specifications.

1.18 USE OF MUNICIPAL WATER SUPPLY

A. The Contractor shall obtain and pay for all permits necessary for the use of municipal water supplies on the project.

B. Water tank trucks used on the project for any purpose shall conform in all respects to the requirements of the New York State Sanitary Code which includes requirements for an "Air Gap" backflow prevention device in the filling system.

C. All connections to hydrants for construction purposes where permitted, shall be equipped with a backflow prevention device meeting the approval of the local water district or other governing authority.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The items listed below beginning with Article 1.4, refer to and are the same pay items listed in the Itemized Proposal. They constitute all the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, plant services, layout surveys, job signs, sanitary requirements, testing, reparation of damages produced by Contractor, safety devices, approval and Record Drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, Bonds, insurance, and all other requirements of the Contract, General and Supplementary Conditions. Compensation for all such services, things and materials shall be included in the price stipulated for the lump sum listed herein.

1.2 ESTIMATE OF QUANTITIES

A. The estimated quantities for unit bid prices, as listed in the Itemized Proposal, are approximate only and are included solely for the purpose of comparison of Bids. The Owner does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required will correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity as the Owner may deem necessary. Any allowance for a change in the unit price shall apply only to that portion of work in excess of 125% of the original contract item quantity, or to the actual amount of work performed if the quantity decreases below 75% of the original contract item quantity. The Contractor or the County, as the case may be, must make written notice to the other party of the change in the quantity of a major item if that party wishes to adjust the contract price or time of performance. Knowledge of a change in quantity could result from receipt of a change order (approved or unapproved), a letter directing a change in the contract work, review of plan details and estimates, review of work completed or progress payment quantities, or a combination of the above.

1.3 RELATED PROVISIONS SPECIFIED ELSEWHERE

A. Payments to Contractor: Refer to Contract, General Conditions and Supplementary Conditions.

1.4 BID PROPOSAL ITEMS

A. Bid Item A – Soil Erosion and Sediment Control

1. Payment for Bid Item A will be the lump sum bid under this item and will be full compensation for furnishing all labor, equipment and materials as shown on the Contract Drawings and as specified, unless otherwise included under other bid items.

B. Bid Item B – Traffic Control

1. Payment for Bid Item B will be the lump sum bid under this item and will be full compensation for furnishing all labor, equipment and materials as shown on the Contract Drawings and as specified, unless otherwise included under other bid items.

C. Bid Item C – Con Edison Fee Allowance

1. Payment will be made only for the actual fees charged by Con Edison for electrical equipment, transformers, etc.

1. The amount paid for this item, shall not include any mark-up of Con Edison's fees.

D. Bid Item D - Cement Lined Ductile Iron Water Main Pipe - 12" diameter, Furnished and Installed

1. Measurement and payment for Bid Item D will be made only for the quantity of 12" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed as shown on the Contract Drawings and as ordered in writing by the Engineer.

2. Measurement shall be in linear foot measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid per linear foot for 12" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed shall include the furnishing of all labor, tools, equipment, excavation, backfilling, compaction, testing and essentials necessary to complete the work specified.

E. Bid Item E - Cement Lined Ductile Iron Water Main Pipe - 10" diameter, Furnished and Installed

1. Measurement and payment for Bid Item E will be made only for the quantity of 10" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed as shown on the Contract Drawings and as ordered in writing by the Engineer.

2. Measurement shall be in linear foot measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid per linear foot for 10" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed shall include the furnishing of all labor, tools, equipment, excavation, backfilling, compaction, testing and essentials necessary to complete the work specified.

F. Bid Item F - Cement Lined Ductile Iron Water Main Pipe - 6" diameter, Furnished and Installed

1. Measurement and payment for Bid Item F will be made only for the quantity of 6" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed as shown on the Contract Drawings and as ordered in writing by the Engineer.

2. Measurement shall be in linear foot measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid per linear foot for 6" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed shall include the furnishing of all labor, tools, equipment, excavation, backfilling, compaction, testing and essentials necessary to complete the work specified.

G. Bid Item G - Cement Lined Ductile Iron Water Main Pipe - 4" diameter, Furnished and Installed

1. Measurement and payment for Bid Item G will be made only for the quantity of 4" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed as shown on the Contract Drawings and as ordered in writing by the Engineer.

2. Measurement shall be in linear foot measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid per linear foot for 4" Diameter Cement Lined Ductile Iron Watermain Pipe, furnished and installed shall include the furnishing of all labor, tools, equipment, excavation, backfilling, compaction, testing and essentials necessary to complete the work specified.

H. Bid Item H - Ductile Iron Watermain Fittings, furnished and installed

1. Measurement and payment for Bid Item H will be made only for the quantity of Ductile Iron Watermain Fittings furnished and installed as shown on the Contract Drawings or as ordered in writing by the Engineer.

2. Measurement shall be in pounds measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid for Ductile Iron Watermain Fittings, furnished and installed shall include the furnishing of all labor, tools, equipment, backfilling, compaction, testing and essentials necessary to complete the work specified.

I. Bid Item I – Inline Gate Valve – 12", furnished and installed

1. Measurement and payment for Bid Item I will be made only for the quantity of 12" Gate Valves, furnished and installed as shown on the Contract Drawings or as ordered in writing by the Engineer.

2. Measurement shall be each measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid for each Inline Gate Valve – 12", furnished and installed shall include the furnishing of all labor, tools, equipment, backfilling, compaction, testing and essentials necessary to complete the work specified.

J. Bid Item J – Inline Gate Valve – 10", furnished and installed

1. Measurement and payment for Bid Item J will be made only for the quantity of 10" Gate Valves, furnished and installed as shown on the Contract Drawings or as ordered in writing by the Engineer.

2. Measurement shall be each measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid for each Inline Gate Valve – 10", furnished and installed shall include the furnishing of all labor, tools, equipment, backfilling, compaction, testing and essentials necessary to complete the work specified.

K. Bid Item K – Inline Gate Valve – 6", furnished and installed

1. Measurement and payment for Bid Item K will be made only for the quantity of 6" Gate Valves, furnished and installed as shown on the Contract Drawings or as ordered in writing by the Engineer.

2. Measurement shall be each measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid for each Inline Gate Valve – 6", furnished and installed shall include the furnishing of all labor, tools, equipment, backfilling, compaction, testing and essentials necessary to complete the work specified.

L. Bid Item L – Inline Gate Valve – 4", furnished and installed

1. Measurement and payment for Bid Item L will be made only for the quantity of 4" Gate Valves, furnished and installed as shown on the Contract Drawings or as ordered in writing by the Engineer.

2. Measurement shall be each measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid for each Inline Gate Valve – 4", furnished and installed shall include the furnishing of all labor, tools, equipment, backfilling, compaction, testing and essentials necessary to complete the work specified.

M. Bid Item M – Insertion Valve (Live Shut-Down) – 12", furnished and installed

1. Measurement and payment for Bid Item M will be made for the quantity of EACH Insertion Valve furnished and installed, as ordered in writing by the Engineer. Refer to specification section 33 12 16.

2. Measurement shall be for EACH insertion valve furnished and installed as measured by the Engineer.

3. The price bid for EACH Insertion Valve shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to excavate, install, backfill and properly compact as ordered by the Engineer.

N. Bid Item N - Fire Hydrant Assembly, furnished and installed

1. Measurement and payment for Bid Item N will be made only for the quantity of Fire Hydrants furnished and installed as shown on the Contract Drawings or as ordered in writing by the Engineer.

2. Measurement shall be each measured in the field based on the payment limits shown in the Contract Drawings and approved by the Engineer.

3. The price bid for each Fire Hydrant, furnished and installed shall include the furnishing of all labor, tools, equipment, backfilling, compaction, testing and essentials necessary to complete the work specified.

O. Bid Item O - Rock Removal and Disposal

1. Measurement and payment for Bid Item O will be made only for the quantity of rock encountered and required to be removed and disposed of in order to install the proposed work. Refer to specification section 31 23 16.26.

2. Measurement shall be in cubic yards measured in the excavation based on the payment limits shown in the Contract Drawings or approved by the Engineer.

3. The price bid per cubic yard for Rock Removal and Disposal shall include the furnishing of all labor, tools, equipment and essentials necessary to complete the work specified including transportation to and disposal costs at an approved disposal facility.

P. Bid Item P – Temporary Asphalt Pavement, furnished and placed

1. Measurement and payment for Bid Item P will be made for the quantity of Temporary Asphalt Pavement furnished and installed, as shown on the contract drawings or as ordered in writing by the Engineer.

2. Measurement shall be for Ton of Temporary Asphalt Pavement, furnished and placed as measured by the Engineer.

3. The price bid for Temporary Asphalt Pavement shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

Q. Bid Item Q – Asphalt Top Course, furnished and placed

1. Measurement and payment for Bid Item Q will be made for the quantity of Asphalt Top Course furnished and installed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Ton of Asphalt Top Course, furnished and placed as measured by the Engineer.

3. The price bid for Asphalt Top Course shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

R. Bid Item R – Asphalt Binder Course, furnished and placed

1. Measurement and payment for Bid Item R will be made for the quantity of Asphalt Top Course furnished and installed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Ton of Asphalt Binder Course, furnished and placed as measured by the Engineer.

3. The price bid for Asphalt Binder Course shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

S. Bid Item S – Pavement Sawcutting

1. Measurement and payment for Bid Item S will be made for the quantity of Pavement Sawcutting, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for linear-foot of Pavement Sawcutting, furnished and placed as measured by the Engineer.

3. The price bid for Pavement Sawcutting shall include the furnishing of all labor, tools, equipment, and essentials necessary to complete the work.

T. Bid Item T – Sub-base Course, furnished and placed

1. Measurement and payment for Bid Item T will be made for the quantity of Sub-base Course furnished and installed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Cubic-yard of Sub-base Course, furnished and placed as measured by the Engineer.

3. The price bid for Sub-base Course shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

U. Bid Item U – Select Fill, furnished and placed

1. Measurement and payment for Bid Item U will be made for the quantity of Select Fill, furnished and placed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Cubic-yard of Select Fill, furnished and placed as measured by the Engineer.

3. The price bid for Select Fill, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

V. Bid Item V – Bedding Sand, furnished and placed

1. Measurement and payment for Bid Item V will be made for the quantity of Bedding Sand, furnished and placed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Cubic-yard of Bedding Sand, furnished and placed as measured by the Engineer.

3. The price bid for Bedding Sand, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

W. Bid Item W – Exploratory Excavations (Test Pits)

1. Measurement and payment for Bid Item W will be made only for the quantity of Exploratory Excavations performed by the contractor, as ordered in writing by the Engineer. Refer to specification section 02 32 19. Measurement shall be in cubic yards measured in the excavation.

2. The price bid per cubic yard for Exploratory Excavations shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to excavate and backfill price will include hand excavation, as necessary.

X. Bid Item X – Controlled Low Strength Material

1. Measurement and payment for Bid Item X will be made only for the quantity of Controlled Low Strength Material furnished and placed by the contractor, as shown on the contract drawings or as ordered in writing by the Engineer. Refer to specification section 03 34 00. Measurement shall be in cubic yards measured in the excavation.

2. The price bid per cubic yard for Controlled Low Strength Material shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to complete the work.

Y. Bid Item Y – Waste Transportation and Disposal

1. Measurement and payment for Bid Item Y will be made only for the quantity of Waste Transportation and Disposal removed and disposed by the contractor, as shown on the contract drawings or as ordered in writing by the Engineer. Refer to specification section 02 80 00. Measurement shall be in cubic yards measured in the excavation.

2. The price bid per cubic yard for Waste Transportation and Disposal shall include the furnishing of all labor, tools, equipment, permitting, samples, tests, characterization, excavation, storage, trucking, disposal and essentials necessary to complete the work.

Z. Bid Item Z – Crushed Stone, furnished and placed

1. Measurement and payment for Bid Item Z will be made for the quantity of Crushed Stone, furnished and placed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Cubic-yard of Crushed Stone, furnished and placed as measured by the Engineer.

3. The price bid for Crushed Stone, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

AA. Bid Item AA – Topsoil, furnished and placed

1. Measurement and payment for Bid Item AA will be made for the quantity of Topsoil, furnished and placed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Cubic-yard of Topsoil, furnished and placed as measured by the Engineer.

3. The price bid for Topsoil, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish, place, and properly compact.

BB. Bid Item BB – Grass Seed, furnished and placed

1. Measurement and payment for Bid Item BB will be made for the quantity of Grass Seed, furnished and placed, as shown on the contract drawings or ordered in writing by the Engineer.

2. Measurement shall be for Square-yard of Grass Seed, furnished and placed as measured by the Engineer.

3. The price bid for Grass Seed, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary to furnish and place.

CC. Bid Item CC – Culvert Replacement

1. Payment for Bid Item CC will be the lump sum bid under this item and will be full compensation for furnishing all labor, equipment and materials necessary for the demolition and replacement of the concrete drainage culvert in New King Street.

2. The price bid for Culvert Replacement, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary including saw cutting, removal and disposal of the existing culvert, concrete, steel reinforcing, stone channel bottom, backfill and compaction as shown on the Contract Drawings and as specified, unless otherwise included under other bid items.

DD. Bid Item DD – Meter Vault

1. Payment for Bid Item DD will be the lump sum bid under this item and will be full compensation for furnishing all labor, equipment and materials necessary for furnishing and installing the pre-manufactured meter vault and associated equipment.

2. The price bid for Meter Vault, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary including excavation, excavation support, dewatering, concrete foundation, crane, vault,

equipment, meters, piping, electrical, conduits, utility pole, backfilling, restoration, testing, calibration, as shown on the Contract Drawings and as specified.

EE. Bid Item EE – Tower Road Backflow Building

1. Payment for Bid Item EE will be the lump sum bid under this item and will be full compensation for furnishing all labor and materials necessary for construction of a new backflow preventer building and associated equipment.

2. The price bid for Backflow Building, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary including excavation, dewatering, concrete foundation, building structure, equipment, meters, piping, electrical, conduits, connections, testing, grading, restoration, calibration, as shown on the Contract Drawings and as specified. Price bid shall include the demolition of the existing backflow preventer building.

FF. Bid Item FF – Airport Road Backflow Building

1. Payment for Bid Item FF will be the lump sum bid under this item and will be full compensation for furnishing all labor and materials necessary for construction of a new backflow preventer building and associated equipment.

2. The price bid for Backflow Building, shall include the furnishing of all labor, tools, equipment, samples, tests and essentials necessary including excavation, dewatering, concrete foundation, building structure, equipment, meters, piping, electrical, conduits, connections, fencing and gates, grading, restoration, testing, calibration, as shown on the Contract Drawings and as specified.

GG. Bid Item GG – Groundwater Treatment and Disposal

1. Measurement and payment for Bid Item GG will be lump sum bid under this item and will be full compensation for furnishing all labor, equipment, and materials necessary for the treatment and disposal of groundwater removed, for the purpose of constructing the work shown on the Contract Drawings and as specified. The cost of this item is delineated on the Proposal Sheet and shall be included in the total amount bid for the project.

HH. Bid Item HH – Mobilization

1. This item provides payment for Mobilization which must not exceed 2% of the subtotal of Bid Items A through GG.

2. The lump sum price bid for this Item shall include all labor, equipment, and materials necessary for Mobilization for the purpose of constructing the

work shown on the Contract Drawings and as specified.

II. Bid Item II – Contract Bonds and Insurance

1. This item provides payment for Contract Bonds and Insurances which must not exceed 3% of the subtotal of Bid Items A through GG.

2. The lump sum price bid for this Item shall include all preparation effort required to complete the work.

JJ. Bid Item W-800 – Miscellaneous Work Allowance

1. This item provides for miscellaneous additional work to be accomplished as ordered by the Owner. The cost of this item is delineated on the Proposal Sheet and shall be included in the total amount bid for the project.

2. The basis for payment under this Allowance will be that amount substantiated by invoices from the supplier of equipment, materials or services selected and ordered in writing by the Owner plus Contractor's overhead and profit as defined in the General Clauses.

3. It is understood that should additional work i.e., equipment, materials, and/or services, be ordered by the Owner during the performance of the specified Contract, the cost for this additional work will be paid for under the dollar allowance included in the bid. Should no additional work be ordered by the Owner or if the value of the ordered additional work is less than the total dollar amount of the allowance included in the bid (as noted on the Bid Sheet) then the total final Contract amount (total dollar amount due Contractor) will be reduced by the dollar amount of allowance unused. Any work ordered above this allowable dollar amount will be paid in accordance with the General Conditions.

KK. Bid Item W-851 – Testing of Materials and Field Testing Equipment

1. This item provides for Testing of Materials and Field Testing Equipment per Article "Testing of Materials and Field Testing Equipment (Item W-851)" of General Requirements, as ordered by the Owner. The cost of this item is delineated on the Proposal Sheet and shall be included in the total amount bid for the project.

1.5 DAMAGES BY CONTRACTOR

A. No payments shall be made for reparation of damages caused by Contractor.

1.6 CONTRACTOR PAY REQUISITIONS

A. The Contractors shall submit monthly payment requisitions, prepared as directed by the Engineer. A maximum of one payment requisition shall be submitted each month.

B. The Contractor may, at the approval of the Engineer, submit payment for unit cost items based upon agreed upon estimated amounts each month prior to completion of as built surveys.

+ + END OF SECTION + +

SECTION 01 32 00

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 GENERAL

A. Contractor shall prepare the project construction schedule to include all required activities.

B. The Contractor shall conform to the following sequence of events, as applicable, to prepare the project construction schedule.

1. The Contractor prepares his preliminary schedule and submits same to the Engineer within 15 days after date of the Notice to Proceed.

2. The Contractor revises preliminary schedule to reflect input of the Engineer and submits same back to the Engineer no later than 15 days after the receipt of input of the Engineer.

3. The Contractor maintains the schedule and updates the schedule as specified herein.

C. The construction schedule shall be prepared in accordance with the following requirements:

1. Content – Supply the following information on the Construction Schedule:

a. Shop drawing submittal dates and required approval dates.

b. Product and equipment delivery dates.

c. Factory and field testing dates.

d. Dates for beginning and completing each phase of the work by activity and by trades.

2. Format

a. Type – Horizontal bar chart.

b. Sheet Size – 24 inches by 36 inches.

c. Time Scale – Indicate first date in each work week.

d. Activity Designations – Show title and related specification section number.

3. Organization

a. Group shop drawing submittal and reviews into separate subschedule.

b. Group product deliveries into a separate subschedule.

c. Group construction work into a separate subschedule by activity.

d. Group critical activities which dictate the rate of progress into a separate subschedule.

e. Organize each subschedule by Specification Section number.

4. Coordination

a. To assure completion of the Work within the established time of completion, all activities of the Contractor will be scheduled and monitored by use of the Official Project Schedule.

b. In the preparation of the construction schedule, the Contractor shall take into consideration shop drawing submittal and approval time, the delivery time of equipment and materials, subcontractors work, availability and abilities of workmen, weather conditions, and restrictions in operations at the Project site, and all other items that may affect completion of the Work within the time requirements of the Contract Documents.

D. Schedule Updating

1. Weekly Progress – The Contractor shall submit a weekly progress report to the Engineer. The weekly reports shall include manpower and work activities. The Contractor will include a copy of the portion of the Official Project Schedule relating to the activities involved during that week. This information will be used as a checklist on which the Contractor and their subcontractors will indicate start and finish dates for all activities as well as percentage of completion. In addition, the Contractor will indicate which activities they plan to start the following week.

2. Construction Schedule Update – The Contractor shall submit monthly updates of the Schedule. The updates shall be reviewed at monthly update meetings (or lesser intervals if deemed necessary). Monthly updates shall indicate the following:

a. Approved changes in activity sequencing.

b. Changes in activity durations for unstarted or partially complete activities where agreed upon.

c. The effect of any delays to any activities in progress and/or the impact of known delays which are expected to affect future work.

d. The effect of Contractor Modifications on activity duration.

e. Changes to activity logic, where agreed upon, to reflect revision in the Contractor's plan, i.e., changes in activity duration, and activity sequence for the purpose of regaining lost time or improving progress.

f. Changes to milestones, due dates and the overall Contract Completion Date, which have been agreed upon by the Owner since the last revision of the Schedule.

The schedule shall accurately reflect the manner in which the Contractor intends to proceed with the project and shall incorporate the impact of all delays and Change Orders as soon as these factors can be defined. All changes made to the schedule shall be subject to approval by the Owner prior to inclusion in the Schedule. When the Owner and the Contractor are unable to agree as to the amount of time to be allowed for Change Order work, or the manner in which this work is to be reflected, this shall reflect the logic and time durations furnished by the Contractor for the Change Order pending final Owner decision. If unapproved Contractor logic and time durations are used, the Contractor agrees that any time which is projected to be lost on the project as a result of these schedule changes will be considered the responsibility of the Contractor until a final agreement has been made or a final decision rendered by the Owner regarding the manner in which the Change Order work is to be reflected on the Schedule. When this final decision has been made by the Owner, the Schedule shall be revised in accordance with such decision and issue a final analysis of the effect of the change on the project.

If the Contractor desires to revise the logic of the approved Schedule so as to reflect a sequence of construction which differs from that originally agreed to, he must first obtain approval of the Owner. If this change extends the completion date of the project or delays work, the Contractor agrees that that these impacts and all associated cost will be considered a claim to be assessed against the Contractor initiating the change and will not be the basis for a project time extension. The change will not be used as a basis of a claim against the Owner.

Once each month, at the same time the schedule is updated, the Owner and the Contractor shall jointly make entries to identify those activities stated by date and those completed by date during the previous period, to show estimated time required to complete each activity started but not yet completed, to show activity precent completed and to reflect any changes in the schedule approved in accordance with the preceding paragraph. After completion of the joint review, an updated schedule will be generated by the Contractor.

E. Time Extensions – The Engineer will issue time extensions, subject to the approval of the Owner, as may be necessary whenever delays occur which satisfy the requirements of the Contract and which effect critical work sequences or which have such an impact that the delay exceeds the available float.

Time extensions will not be granted unless substantiated by the schedule and then not until the project contingency becomes zero.

The contract completion time or times will be adjusted only for causes specified in this Contract. In the event a Contractor requests an extension of any Contract Completion Date, he shall furnish such justification and supporting evidence that the Engineer requires to evaluate the finding of fact and advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any Contract Completion Date under the provisions of this Contract, the determination as to the total number of days extension shall be based upon the currently approved schedule and on all data relevant to the extension. Such data will be included in the next updating of the schedule.

A total project time extension may be issued if delays which are determined to be beyond the control of the Contractor affect the main project critical path shown on the Schedule, thereby directly extending the final project completion date.

Contractor shall acknowledge and agree that the evaluation of project delays and determinations regarding project time extension will be based upon the project Schedule and the following criteria:

1. Float time shown on the Schedule is not for the exclusive use of either the Contractor or the Engineer. It is agreed that float time is available for use by all parties to facilitate the effective use of available resources and to minimize the impact of problems or change orders which may arise during construction. Contractor shall specifically agree that float time may be used by the Owner or their Engineer in conjunction with their review activities or to resolve project problems. Contractor agrees that there will be no basis for a project time extension or a delay claim as a result of any project problem, Change Order or delay which only results in the loss of available positive float on the project schedule.

Contractor further agrees that there will be no basis for a claim for cost escalation for any activity which is completed on or before its initially required late end date, as shown on the initial approved schedule, regardless of the justifiability of any delaying factors which might have resulted in elimination of float which was originally available for the activity.

2. Contractor agrees that no time extension will be granted for time lost due to normal seasonal weather conditions. In order to qualify for consideration for a time extension due to adverse weather conditions, it must be shown that the weather conditions during a given quarterly period (summer, fall, winter, spring) were more severe than geographical area and, in addition, that these weather conditions critically impacted the final project completion date by delaying the performance of work on the main project critical path. If abnormal weather losses can be shown to have affected the project critical path, a non-compensable time extension will be considered for that portion of the proven weather-related delays which exceeded the normal weather losses which should have been anticipated for the quarterly period in question.

   No time extensions will be considered for any weather impacts which do not affect work on the main project critical path. Contractor agrees that there will be no basis for a claim for any additional compensation resulting from any time extension issued for weather- related delays.

3. In order for a given issue (i.e., delay, Change Order, etc.) to be considered as a basis for a total project time extension, it must meet both of the following criteria:

   a) It must be totally beyond the control of the Contractor and due to no direct or indirect fault of the Contractor; and

   b) It must result in a direct delay to work on the main project critical path.

4. Contractor acknowledges and agree that actual delays to activities which, according to the schedule, do not directly affect the main project critical path do not have any effect on the Contract Completion Date or dates and will not be the basis for a change therein.

5. Concurrent delays are defined as two (2) or more delays or areas of work slippage which are totally independent of one another and which, if considered individually, would each affect the final project completion date according to the Schedule.

Where the Engineer determines that concurrent delays exist, Contractor acknowledges and agree that the following criteria will be used to evaluate time extension:

a) If the current schedule shows two (2) or more concurrent delays, with one (1) analyzed to be the responsibility of the Owner and the other analyzed to be the responsibility of the Contractor, a time extension will only be considered if the Owner- caused delay affects the main project critical path and if this delay is shown by greater amount than the other concurrent delays when their impacts are independently considered. In this event, a time extension will only be considered for that portion of time by which the Owner-caused delay exceeds all concurrent non-Owner caused delays. For example, if an Owner-caused impact delays the project by 100 days and a concurrent Contractor-caused slippage independently delays the final completion date by 90 days, a compensation time extension will only be considered for a maximum of ten (10) days, provided the Owner caused delay is on the project critical path.

The Contractor acknowledges and agree that for the purposes of considering a time extension request, an activity will not be considered to have been subject to a claimed delay unless all originally scheduled predecessor activities have been completed so that no other restraints to the performance of that activity exist on the schedule at the time claimed for the delay impact.
Each request for change in any Contract Completion Date shall be submitted by the Contractor to the Engineer within ten days after the beginning of the delay for which a time extension is requested (unless the Engineer grants a further period of time before the date of final payment under this contract). No time extension will be granted for requests which are not submitted within the foregoing limit. No time extension request shall be considered unless it specifically contains at least the following detailed information:

1) Date delay began;

2. Date delaying impact was resolved;

3) Detailed chronology of delay including the dates of all applicable notifications and submittals;

4) Specific critical path activities affected and the dates of impact; and

5) In the case of Change Order Work, an analysis must be furnished showing the specific work required and the

manner in which this work will be interfaced with the schedule.

F. Delays Claims

1. Logs of Activity Performance - The Engineer will maintain a complete log of the actual start and finish date of each schedule activity as well as its percentage of completion for each month of the project. Records will also be carefully maintained of all changes in activity sequencing, duration, crew size and payment estimates, scope, etc. Change order or disputed work will be monitored on a daily basis, both for schedule performance and the manpower and cost of achieving daily performance.

2. Planned, Adjusted and As-Built Schedules - Information maintained by the Engineer will be used by the Owner as necessary in the preparation of AS-PLANNED, ADJUSTED AS-PLANNED and AS-BUILT network schedules for analysis of the extent and responsibility for any claimed delay. The amount of any equitable adjustment to the Contract will be determined both from the extent of the delay and the reasonable damages incurred by the Contractor based on considerations of the approved payment values of the base contract or changed contract work and/or recorded costs of disputed work.

G. Prevention of Delays - If Contractor causes a delay or is about to cause a delay due to lack of manpower or lack of construction equipment, the Engineer shall have the authority to direct the Contractor to add such additional resources as may be necessary, in the Engineer's opinion, to maintain or to regain schedule dates.

H. Penalties for Late Completion - This project has liquidated damage provisions as stipulated in the Contract. Information provided by the updating of the schedules will be utilized in determining responsibility for delays in the schedule. Should construction carry on beyond contract termination date, Contractor's financial responsibility will be so determined using the Official Project Schedule.

I. Compliance with the Schedule - If the Contractor fails to adhere to the Official Construction Schedule, or to its latest update, the Contractor must promptly adopt such other or additional means and methods of construction as will make up for the time lost and will assure completion of the work in accordance with said schedule. In the event a notice is received of a change in the contract or any extra work to be performed, or of any other conditions which are likely to cause or are actually causing delays, the Contractor shall notify the Engineer in writing within 10 days of the effect, if any, of such change, or extra work, or suspension or other conditions upon the Official Construction Schedule and shall state in what respects, if any, the Official Construction Project Schedule should be revised with the reasons therefore.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 PROGRESS PHOTOS

A. The Contractor shall engage and pay for the services of a professional photographer to make photographs prior to accessing the site and each month thereafter at locations and at such stages of construction as directed by the Engineer. Upon completion of the project a minimum of fifty (50) views of the project site shall be taken as directed by the Engineer to indicate the general extent of the work.

B. In addition, photographs shall be taken of all unusual construction areas and at street crossings, paved driveway crossings, and at all points of possible future controversy before any work at these points is started.

C. The Contractor shall deliver one (1) print of each photo to the Engineer. Photographs shall be 8 x 10 inches in size, and shall have the following information typed and placed on the back of each photo.

1. Title of project, photograph number (consecutive).

2. Location of photograph and direction of view relative to project stationing.

3. Date.

4. Description of photograph including portion of work.

5. Contractor’s name.

D. Contractor shall also deliver an electronic copy of progress photographs on a flash drive. Flash drive shall include a printed label with Contractor name, contract name and number, and date of photos.

E. The selection of the subject matter and the time for taking photographs shall be determined by the Engineer. Fifty (50) photographs showing features of the work during each stage of the work, shall be furnished each month. In addition to the above photographs, the Contractor shall provide preconstruction and post-construction photos (50) and videos of the entire project area.

F. The Contractor shall also videotape specific areas just prior to excavation. Preconstruction and post-construction filming shall be taken of the site for the entire project. Preconstruction filming shall be taken before any work is started. Post-construction filming shall be taken immediately after all work has been completed. Filming shall be taken to especially note the condition of any

structures, lawns, trees, sidewalks, fences, etc. on and adjacent to the work to ascertain whether or not these items have been replaced to their original condition. Ownership of the videotapes shall remain with the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This Section specifies the requirements for making submissions for the project.

1.2 IDENTIFICATION OF SUBMITTALS

A. Each and every submission shall be provided by the Contractor and shall be accompanied by a SUBMISSION TRANSMITTAL FORM. Identify each submittal and re-submittal using the form.

B. It is incumbent on the Contractor to initially assign the submission log number designation to each submission. Submissions not containing a log number, as specified above, will be returned to the Contractor un-reviewed by the Engineer/Architect.

C. Every submittal shall also be accompanied by a Transmittal Letter addressed to the Engineer/Architect's Project Manager.

1.3 COORDINATION OF SUBMITTALS

A. Prior to submitting to the Engineer/Architect, fully coordinate all interrelated work. As a minimum, do the following:

1. Determine and verify all field dimensions and conditions by field measuring existing conditions and the installed work of this Contract and work by others.

2. Coordinate with all trades, subcontractors, vendors, system and equipment suppliers and manufacturers, public agencies, and utility companies and secure all necessary approvals, in writing.

3. Provide a space approximately 4" x 4" on submission transmittal form, transmittal letter, and shop drawings to record the Engineer's review, approval markings and the action taken.

B. Make submittals in groups containing all associated items that in some way depend upon each other.

1. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

2. The Engineer/Architect may elect not to review partial or incomplete submissions, whereupon he will notify the Contractor of the additional submissions that are required before a review can be made.

1.4 TIMING OF SUBMITTALS

A. Make submittals far enough in advance of scheduled dates of installation to provide time for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery. The Engineer/Architect will review submittals in a manner as expedient as possible, and will generally send a written response to the Contractor within seven (7) calendar days of receipt of submittals.

B. Submissions may be returned reviewed, rejected, returned conditioned upon submission of related items, or for other reasons set forth in the Contract Documents.

C. Make submissions well in advance as the returning, rejecting or disapproval of submissions or other similar circumstances are possible and are deemed "avoidable delays". Costs for these delays or those attributed to Contractor's tardiness in making submittals shall be borne by the Contractor.

D. Submittals requiring Engineer/Architect's review (except operations manuals) as required under the technical specifications of these documents shall be submitted prior to installation.

E. Operations and maintenance manuals shall be submitted at least thirty (30) consecutive calendar days prior to scheduled start-up of the unit or system.

F. If material or equipment is installed before it has been deemed to be in general compliance with the Contract Documents, as determined by the Engineer/Architect, the Contractor shall be liable for its removal and replacement at no extra charge and without an increase in contract time.

G. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer.

1.5 DESTINATION OF SUBMITTALS

A. Submissions shall be sent to the Engineer/Architect's office to the attention of the Project Manager whom will be named in the Notice to Proceed or at the Construction Kick-Off meeting.

B. When submitting samples, the contractor shall arrange for the delivery of said samples to the office of the Engineer. Samples shall be clearly marked with name of the project and the Engineer/Architect's project manager.

C. The Contractor is responsible for the pick-up of the sample from the Engineer's office following approval. In the event that a sample is not retrieved from the Engineer's office within thirty days of approval, it will be disposed of.

1.6 CONTRACTOR'S REPRESENTATION

A. By making a submission, the Contractor represents that he has determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving equipment into an enclosed space, materials, catalog and model numbers and similar data and that he has checked and coordinated each submission with other work at or adjacent to the project site as required

1.7 ENGINEER/ARCHITECT'S REVIEW

A. Engineer/Architect will review and comment on each submission conforming to the requirements of this Section.

1. Engineer/Architect's review will be for conformance with the design concept of the project and will be confined to general arrangement and compliance with the Contract Documents only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, laying lengths, tolerances, interference's, for coordinating the work by others or subcontractors.

2. The Engineer/Architect's review of a separate item, or portion of a system, does not represent a review of an assembly or system in which the item functions.

B. The Engineer/Architect will mark submittals as follows:

1. APPROVED_- No corrections, no marks. The content of this submittal has been reviewed by the Engineer/Architect and been found to be in general compliance with the Contract Documents. No further submission of this

submittal is required and the information contained in the submittal may be built into the work in accordance with the Contract Documents.

2. APPROVED AS NOTED_- Minor amount of corrections. The content of this submittal has been reviewed by the Engineer/Architect and has been found in general to be in compliance with the Contract Documents. The notations made on the submittal by the Engineer/Architect shall be incorporated into the work in accordance with the terms and conditions of

the Contract Documents. No further submission of this submittal is required.

3. REVISE AND RESUBMIT - The content of this submittal has been reviewed by the Engineer/Architect and this review has determined that additional data and/or modification to the submitted data or other changes are required to bring the work represented in this submittal into compliance with the Contract Documents. This submittal shall be reviewed and revised in accordance with the Engineer/Architect's comments and resubmitted to the Engineer/Architect for review. The information contained on the resubmittal shall not be incorporated into the work until the submittal is returned to the Contractor marked "APPROVED" or "APPROVED AS NOTED".

4. DISAPPROVED - The content of this submittal has been reviewed by the Engineer/Architect and has been determined not to be in accordance with the requirements contained in the Contract Document and requires too many corrections or other justifiable reason. The submittal shall be corrected and resubmitted or a submittal of an alternate shall be provided. No items are to be fabricated under this mark.

5. RECEIVED - This submittal is accepted on the project and filed for record purposes only, in accordance with the terms and conditions of the Contract Documents. Documents marked "RECEIVED" will not be returned.

C. No payment will be made on any item for which a submission is required if such submission:

1. Has not been made,

2. Has been made but was not stamped "Approved" by Engineer/Architect,

3. Has been made and stamped "Approved As Noted", but contractor has not complied with Engineer/Architect's notes marked on the submittal,

4. Has been made and stamped "Approved", but item provided does not conform to the shop drawing nor to the Contract Documents.

D. Submittals not required by these specifications will not be recognized or processed.

E. Provide space for the Engineer/Architect's review stamp.

1.8 RESUBMISSIONS

A. Prepare new and additional submissions, make required corrections, and resubmit corrected copies until found in compliance with the Contract Documents.

B. On, or with, resubmittals, clearly describe revisions and changes made, other than the corrections requested by Engineer/Architect, which did not appear on the previous submissions.

1.9 CONTRACTOR'S RESPONSIBILITIES

A. Engineer/Architect's review of submittals shall not relieve the Contractor of his/her responsibility for any deviation from the requirements of the Contract Documents nor relieve the Contractor from responsibility for errors or omissions in the submittals.

B. No portion of the work requiring a submission shall be commenced until the Engineer/Architect has found the submission in general compliance with the Contract Documents.

C. The Contractor shall provide notification of any specification or drawing deviation.

1.10 MISCELLANEOUS SUBMITTALS

A. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.11 SUBCONTRACTOR LIST

A. The Contractor shall submit, on AIA Form G805, within ten (10) calendar days after the date of the Notice to Proceed, a list of all subcontractors, including the names of the major subcontractors that were submitted at the time of the bid.

1.12 MATERIAL SAFETY DATA SHEETS (MSDS)

A. Comply with "Right to Know" requirements of Chapter 551 of Laws of New York, 1980, concerning notification of the use of toxic substances.

B. Any product or substance used by the Contractor or its subcontractors which is listed in Subpart Z of OSHA Part 1910 Title 29 of the Code of Federal Regulations entitled "Toxic and Hazardous Substances" shall be identified to the Owner/Engineer/Architect by the Contractor's submission of a standard Material Safety Data Sheet (MSDS) in accordance with "Right To Know" requirements.

C. Products will not be permitted to be kept on site without a MSDS.

1.13 SHOP DRAWINGS

A. Submit shop drawings for all fabricated work, for all manufactured items and for items specifically required by the specifications.

B. Submit one (1) copy of each standard drawing, catalog cut, or other material. The Engineer/Architect will return one (1) copy to the Contractor. The Contractor

shall be responsible for providing approved shop drawings to their own subcontractors.

C. Subcontractors shall submit shop drawings directly to the Contractor for checking. Thoroughly check subcontractors' shop drawings for measurements, sizes of members, details, materials, and conformance with the Contract Documents.

1. Return submittals which are found to be inaccurate or in error.

2. Do not submit to the Engineer/Architect until all corrections have been made.

D. Clearly show the relationship of the various parts of the project and where the information provided on the submission depends upon field measurements and existing conditions.

E. The Contractor shall make all measurements, confirm existing conditions, and include them on the shop drawings before making a submission to the Engineer/Architect.

1.14 CERTIFICATIONS

A. Submit certifications of compliance indicated in the Contract Documents.

B. Certifications shall be complete and exact, they shall be properly authenticated by the written signature, in ink, of an owner, officer or duly authorized representative of the person, firm or organization issuing such certification and they shall guarantee that the materials or equipment are in complete conformance with the requirements of these specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 35 29

HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes the minimum requirements for health and safety on the project.

1.2 DEFINITION

A. Safety staff shall mean the safety professional and his safety representative(s) or the safety person.

1.3 GENERAL REQUIREMENTS

A. In prosecuting the work of this Contract, the Contractor shall provide working conditions on each operation that shall be as safe and healthful as the nature of that operation permits. The various operations connected with the work shall be so conducted that they will not be unsafe or injurious to health; and the Contractor shall comply with all regulations and published recommendations of the New York State Department of Labor and all provisions, regulations and recommendations issued pursuant to the Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended, and with laws, rules, and regulations of other authorities having jurisdiction, with regard to all matters relating to safe and healthful working conditions. Compliance with governmental requirements is mandated by law and considered only a minimum level of safety performance. All work shall also be performed in accordance with safe work practice.

B. The Contractor shall be responsible for the safety of the Contractor’s employees, the public and all other persons at or about the site of the work. The Contractor shall be solely responsible for the adequacy and safety of all construction methods, materials, equipment and the safe prosecution of the work.

C. The Contractor shall employ a properly qualified safety professional familiar with all work under this contract whose duties shall be to initiate, review and cause implementation of measures for the protection of health and prevention of accidents.

D. The Contractor shall at all times employ a properly qualified safety person familiar with all work under this Contract whose sole duties shall be to initiate, review and cause implementation of measures for the protection of health and prevention of accidents under this Contract.

E. The safety staff shall be provided with an appropriate work area on the job site to maintain and keep available safety records, up-to-date copies of all pertinent safety rules, regulations and governing legislation, material safety data sheets, and the site safety plan including information concerning foreseeable emergency conditions, location of emergency and telephone contacts for supportive actions.

F. The Contractor shall stop work whenever a work procedure or a condition at a work site is deemed unsafe by the safety staff.

1.4 SUBMITTALS

A. The Contractor shall have a Health and Safety Plan (HASP) prepared, prior to the start of any construction. The HASP shall be available to workers on-site and be submitted to the Engineer and Owner at least 2 weeks before the beginning of any field work. Copies of the plan shall be provided to the Contractors' insurers and their risk managers, if any, by the Contractor.

B. The HASP shall, at a minimum, demonstrate the manner in which the Contractor complies with all Occupational Safety and Health Administration (OSHA) standards applicable to the work to be performed under this Contract and specify safeguards to be implemented to protect worker health and safety. The HASP shall address, at a minimum, the following items in accordance with all applicable OSHA regulations:

1. Health and Safety Organization including resumes of all personnel responsible for health and safety.

2. Project Site Description and Hazard Assessment.

3. Training.

4. Project Site Control.

5. Standard Operating Safety Procedures and Engineering Controls.

6. Personal Protective Equipment (PPE).

7. Personnel Hygiene and Decontamination.

8. Emergency Equipment/First Aid Requirements.

9. Emergency Responses/Contingency Procedures.

10. Confined-Space Entry Procedures.

11. Heat and Cold Stress.

12. Record Keeping.

13. Community Protection Plan.

C. Within 30 days of receiving a Notice to Proceed, the Contractor shall submit the name of a safety professional, employed by the Contractor, responsible for project safety management, and of the safety representative(s) who will work under his direction.

D. Documentation and/or personal references confirming the qualifications will be required. The persons proposed as safety person, safety professional or safety representative(s) may be rejected by the Engineer for failure to have adequate qualifications or other cause.

1.5 QUALIFICATIONS

A. Safety Professional: Recognition as a safety professional shall be based on a minimum of: 1) certification by the Board of Certified Safety Professionals as a Certified Safety Professional and 5 years of professional safety management experience in the types of construction and conditions expected to be encountered on the site. In addition, this individual shall have the OSHA 30-Hour Construction Industry Outreach Training.

B. Safety Person: Qualifications of the safety person must include a minimum of five years of relevant construction experience, two of which are related to safety management. In addition, this individual shall have the OSHA 30-Hour Construction Industry Outreach Training.

C. The Safety staff shall be completely experienced with and knowledgeable of all applicable health and safety requirements of all governing laws, rules and regulations as well as of good safety practice. The safety staff shall not include the project manager, engineer, or superintendent, or anyone else working on the project. The safety staff shall have no other duties except those directly related to safety.

D. Site Workers: All site workers shall have the OSHA 10-Hour Construction Industry Outreach Training.

PART 2 - PRODUCTS

2.1 HEALTH AND SAFETY PLAN

A. The Contractor shall commit to writing a site-specific health and safety plan before the start of any construction.

2.2 ACCIDENT REPORTS

A. The Contractor shall promptly report to the Engineer all accidents involving injury to personnel or damage to equipment and structures, investigate these accidents and

prepare required reports and submit a monthly summary of these accidents. The Contractor must submit a preliminary accident report to the Engineer by the following day at the latest.

1. The summary report, due by the 10th day of the following month, shall include descriptions of corrective actions to reduce the probability of similar accidents.

2. In addition, the Contractor shall furnish to the Engineer a copy of all accident and health or safety hazard reports received from OSHA or any other government agency within one day of receipt.

B. In addition to the reports which the Contractor is required to file under the provisions of the Workmen's Compensation Law, he shall submit to the Engineer on or before the tenth day of each month a report giving the total force employed on his Contract in man-days during the previous calendar month, the number and character of all accidents resulting in loss of time or considered recordable by OSHA, and any other information on classification of employees, injuries received on the work, and disabilities arising therefrom that may be required by the Engineer.

1. The submittal shall also contain an audit report for the prior month, including the safety training conducted, the above equipment logs, records of the condition of the work areas, safety and health records, OSHA and ANSI Z16.1 incidence rates for frequency and severity of recordable accidents, and an evaluation of the effectiveness of the HASP with any changes necessary.

2. The Safety Professional or Safety Person and the Contractor shall sign this audit report. The Engineer will review these reports for Contractor's compliance with the safety provisions of the Contract.

2.3 SAFETY AND RESCUE EQUIPMENT

A. The Contractor shall have proper safety and rescue equipment, adequately maintained and readily available, for any foreseeable contingency. This equipment shall include such applicable items as: proper fire extinguishers, first aid supplies, safety ropes and harnesses, stretchers, water safety devices, oxygen breathing apparatus, resuscitators, gas detectors, oxygen deficiency indicators, combustible gas detectors, etc. as determined necessary by the Contractor during preparation of the HASP.

B. This equipment should be kept in protected areas and checked at scheduled intervals. A log shall be maintained indicating who checked the equipment, when it was checked, and that it was acceptable. This equipment log shall be updated monthly and be submitted with the monthly report. Equipment that requires calibration shall have copies of dated calibration certificates on-site.

C. Substitute safety and rescue equipment must be provided while primary equipment is being serviced or calibrated.

2.4 PROTECTIVE EQUIPMENT

A. All personnel employed by the Contractor or his subcontractors or any visitors whenever entering the job site shall be required to wear appropriate personal protection equipment required for that area. The Contractor shall provide all necessary personal protective equipment as requested by the Engineer for his designated representatives.

PART 3 - EXECUTION

3.1 SAFETY STAFF DUTIES

A. The safety professional shall visit and audit all work areas as frequently as necessary (a minimum of once a week) and shall be available for consultation whenever necessary. The safety staff shall have full authority to implement and enforce the health and safety plan to take immediate action to correct unsafe, hazardous or unhealthful conditions.

B. A member of the safety staff must be at the job site full time (a minimum of 8 hours per working day) whenever work is in progress. When multiple shift work is in progress, more than one safety representative may be required.

C. The safety staff shall as a minimum:

1. Schedule safety training programs as required by law, the safety plan, and good safety practice. An outline of materials to be covered shall be provided with the safety plan. All employees shall be instructed on the recognition of hazards, observance of precautions, of the contents of the safety plan and the use of protective and emergency equipment.

2. Determine that operators of specific equipment are qualified by training and/or experience before they are allowed to operate such equipment.

3. Develop and implement emergency response procedures. Post the name, address and hours of the nearest medical doctor; name and address of nearby clinics and hospitals, and the telephone numbers of the appropriate ambulance service, fire, and the police department.

4. Post all appropriate notices regarding safety and health regulations at locations which afford maximum exposure to all personnel at the job site.

5. Post appropriate instructions and warning signs in regard to all hazardous areas or conditions which cannot be eliminated. Identification of these areas

shall be based on experience, on-site surveillance, and severity of hazard. Such signs shall not be used in place of appropriate workplace controls.

6. Ascertain by personal inspection that all safety rules and regulations are enforced. Make inspections at least once a shift to ensure that all machines, tools and equipment are in a safe operating condition; and that all work areas are free of hazards. Take necessary and timely corrective actions to eliminate all unsafe acts and/or conditions, and submit to the Engineer each day a copy of his findings on the inspection checklist report forms established in the safety plan.

7. Submit to the Engineer, copies of all safety inspection reports and citations from regulating agencies and insurance companies within one work day of receipt of such reports.

8. Provide safety training and orientation to authorized visitors to ensure their safety while occupying the job site.

9. Perform all related tasks necessary to achieve the highest degree of safety that the nature of the work permits.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Engineer.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these

services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.

The Contractor shall employ and pay an independent agency, to perform specified quality control services.

Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.

B. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

C. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

2. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

3. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

4. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

5. Security and protection of samples and test equipment at the Project site.

D. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Engineer and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of

its services.

2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

3. The agency shall not perform any duties of the Contractor.

1.4 SUBMITTALS

The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Engineer, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

A. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

1. Date of issue.

2. Project title and number.

3. Name, address and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making the inspection or test.

6. Designation of the Work and test method.

7. Identification of product and Specification Section.

8. Complete inspection or test data.

9. Test results and interpretations of test results.

10. Ambient conditions at the time of sample-taking and testing.

11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory

Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

1.6 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for section 1045 "Cutting and Patching."

Protect construction exposed by or for quality control service activities, and protect repaired construction.

Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 55 26

TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section includes the provisions of maintaining vehicular and pedestrian traffic within in and around all work areas and protection for both the public and the Contractor's employees from all damage to person and property during the site work improvements.

B. Maintenance and protection of traffic is the responsibility of the General Contractor.

1.2 SUBMITTALS

A. The Contractor shall notify the roadway Owner and the Engineer at least seventy-two (72) hours prior to the closing of any portion of a road as might be necessary to perform the work and shall adequately describe the detour to be followed.

B. The Contractor shall submit detailed drawings showing all signs, barricades, etc. for the closing of any portion of a road. These drawings shall be submitted for the Engineer’s approval prior to any road closings. Only after drawing approval can the Contractor submit a request for road closing 72 hours prior to the anticipated closure. These shop drawings must be in full conformance with the requirements of the Manual of Uniform Traffic Control Devices.

PART 2 - MATERIALS

2.1 TRAFFIC DEVICES

A. All temporary signs, delineators, barricades, lighting, and other warning and guiding devices shall be as shown and specified on the plans, the New York State Manual of Uniform Traffic Control Devices, the Traffic Maintenance Details of the standard details, and/or as required by the roadway owner.

B. Unless otherwise specified, all materials used will remain the property of the Contractor.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor shall obtain, supply and pay for all required electrical energy, services, permits, equipment, certificates, etc.

3.2 PERFORMANCE

A. Traffic shall be maintained over a reasonably smooth traveled way, which shall be marked by signs, delineations, and/or other methods so that a person who has no knowledge of conditions can safely and with a minimum of discomfort and inconvenience, travel the area under construction. Standards for maintenance of traffic shall be based on the New York State Manual of Uniform Traffic Control Devices (referred to as "Manual") current edition.

B. Adequate advance warning according to the "Manual" must be provided whenever traffic is interfered with or lanes are closed. All signs, markings, signals, barricades, lighting devices, and flagger operations shall conform to the "Manual". All necessary traffic control devices shall be available and in place before the particular construction operations are started. In case of emergency construction where there is not sufficient time to prepare a traffic plan, the Contractor shall be responsible for following the guidelines set forth in the "Manual."

C. Access for emergency vehicles is of the utmost importance and provision shall be made by the Contractor to provide such access.

D. Adequate provisions shall also be made for business and commercial establishments, schools, and public buildings.

E. The Contractor shall generally maintain two (2) way traffic on streets where work is in progress and in no case shall he be permitted to work in adjacent streets.

F. The Contractor shall maintain within the work limits the entire pavement, drainage and sewage facilities, and other street elements unless otherwise specified. The traveled way shall be kept well drained, reasonably smooth, cleaned and hard at all times. Foreign objects, sand, rocks, spillage of materials shall immediately be removed and the area cleaned to the satisfaction of the Engineer. Spillage outside the work limits is the Contractor's responsibility and the Owner will entertain no claim for work necessary to clean the areas affected. The Contractor shall be required to remove snow on those streets where roads are not passable by snow plows due to the Contractor's operation.

G. Traffic delays shall be kept to a minimum. A period of five (5) minutes shall be considered the maximum time allowed for stopping traffic.

H. Detour signs, barricades, and other facilities shall be furnished and erected as called for on the contractors approved plan and/or as directed by the roadway owner. The route of the detour shall be clearly marked at the beginning and end with directions at intermediate points along its entire length.

I. The Contractor shall be responsible for notifying all interested agencies when detours or construction will interfere with the normal traffic flow. These agencies include, but are not limited to:

1. Westchester County Department of Public Works & Transportation

2. Town of Harrison (for Town roads)

3. Westchester County Airport Operations

4. Westchester County Police Department

5. Town of North Castle (for Town roads)

J. The Contractor will not be permitted to store spoil, materials, equipment, or supplies that will interfere with sight distances within thirty (30) feet of an intersection or areas where sight distance is critical.

K. When travel must be diverted from the accustomed traveled way on to some other area, the Contractor shall grade, repair, stabilize, and provide ramps if necessary, to provide for the smooth flow of traffic. Upon completion of construction, the area utilized shall be restored to its original condition.

L. The Contractor shall construct and maintain, where called for on the plans or as directed by the roadway owner, temporary bridges or bridging over excavations, obstructions, and newly laid pavements to provide access for pedestrian and vehicular traffic and access to fire hydrants. During construction, the Contractor shall take particular care to allow the ingress and egress of emergency vehicles from firehouses, police stations, hospitals, etc. Adequate provisions shall also be made for business and commercial establishments, schools, and for public buildings. Plating and/or bridging is required at all main intersections and heavily traveled crossings.

M. Street signs, route markers, and other signs that fall under public jurisdiction, i.e., Bus Stop, Stop Signs, Parking Signs, etc., shall be protected and maintained or removed, stored, cleaned, and replaced when ordered by the roadway owner. The roadway owner may also order that these signs be temporarily relocated and then reinstalled in their original location. If in the course of construction, it becomes necessary to temporarily move a Bus Stop, the temporary site shall be approved by the County or local jurisdiction.

N. The Contractor shall provide protection from damage to person or property by protective screens, fences, devices, or methods that are approved by the roadway owner.

O. All signs, lights, barricades, and other materials installed to direct or warn the traveling public shall be maintained, repaired, and replaced by the Contractor. Vandalism or theft shall not preclude requirement and special attention shall be given to Traffic Maintenance and Protection during nonworking hours, weekends, holidays, and other periods or temporary shutdown of work.

P. Materials, equipment, and workmanship for lighted barricades shall be in strict compliance with the National Electric Code and only a licensed electrician may perform the work.

Q. Signs or markers lost, damaged, or removed by the Contractor shall be replaced at no cost to the Owner. Signs not to be replaced shall be cleaned and delivered to the Engineer.

R. Temporary reflectorized pavement markings shall be placed where existing markings are obliterated, whenever it is determined that the roadway would be void of traffic markings for two (2) weeks or more, or as otherwise directed by the roadway owner and Engineer. The temporary markings shall provide the same number of through travel lanes as the previously existing markings.

S. Sheeting

1. Sheeting around excavations shall project four (4) feet above the surface of the ground to form a tight barricade. Where this requirement cannot be met, the excavation shall be surrounded with a metal fabric supported by approved uprights, set at maximum eight (8) foot intervals.

T. Flagmen

1. Competent flagmen shall be provided by the Contractor when ordered by the roadway owner or Engineer or as directed by the specifications. These flagmen shall have no function other than the direction of traffic. They shall wear safety vests and shall direct traffic with a red flag as required by the New York State Manual of Uniform Traffic Control Devices.

U. Watchmen

1. The Contractor shall provide watchmen service, during all nonworking hours for continuous patrol of the work site whenever excavations are left open overnight or whenever temporary bypass pumping is in place.

2. The watchmen will be responsible for making sure all signs, barricades, flares, and markers are up and in good condition and that the bypass force main is in good working condition.

3. Watchmen shall maintain daily logs of their patrols. Copies of these logs shall be made available to the Owner.

4. In the event that any unusual or emergency condition arises, the watchmen shall immediately notify the Contractor, the Engineer and the appropriate regulatory agency or emergency agency for assistance.

5. The Contractor may apply to the Owner for suspension of the watchmen service following construction but prior to completion of the work (when punch list items remain).

6. A deduction of three hundred (300) dollars per eight hour shift will be made for watchmen services not provided when required.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Traffic Control will be measured for payment at the unit costs listed below to include acceptably placed measures for the construction shown on the plans or directed by the Engineer.

ITEM #	DESCRIPTION	UNIT
B	Traffic Control	LS

4.2. PAYMENT

A. The cost of all labor, materials, equipment and insurance required and necessary to perform all work specified herein, or as ordered, shall be deemed included in the lump sum price bid for "Traffic Control." Payment for the lump sum item shall be made in proportion to the percentage of contract completion.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

1.2 RELATED WORK

A. Not used.

1.3 NOISE CONTROL

A. Contractor's vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and local codes.

1.4 DUST CONTROL

A. Contractor shall be responsible for controlling objectionable dust caused by his operation of vehicles and equipment, clearing or for any reason whatever to the satisfaction of the Engineer.

1.5 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or staging areas.

1. Employ methods and use materials which will not adversely affect conditions at the Site or on adjoining properties.

1.6 WATER CONTROL

A. Provide methods to control surface water and water from excavations to prevent damage to the Work, the Site, or adjoining properties.

1. Control fill, grading and ditching to direct water away from excavations, pits, and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.

B. Provide, operate and maintain equipment and facilities of adequate size to control surface water.

C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the Site or to adjoining areas and in conformance with all environmental requirements.

1.7 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

1. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.

1. Prevent toxic concentrations of chemicals.

2. Prevent harmful dispersal of pollutants into the atmosphere.

E. All Contractor's equipment used during construction shall conform to all current federal, state, local laws and regulations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – MEASUREMENT AND PAYMENT

3.1 MEASUREMENT

NOT USED

3.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. Contractor shall make all arrangements for transportation, delivery, storage and handling of equipment and materials required for prosecution and completion of the Work.

B. Shipments of materials to Contractor or Subcontractors shall be delivered to the Site only during regular working hours. Shipments shall be addressed and consigned to the proper party giving name of Project, street and city. Shipments shall not be delivered to Owner except where otherwise directed.

C. If it is necessary to move stored materials and equipment during construction, Contractor shall move or cause to be moved materials and equipment without any additional compensation.

PART 2 - PRODUCTS

2.1 DELIVERY

A. Arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation.

B. Coordinate deliveries to avoid conflict with Work and conditions at site and to accommodate the following:

1. Work of Owner.

2. Limitations of storage space.

3. Availability of equipment and personnel for handling, products.

4. Owner's use of premises.

C. Do not have products delivered to Project Site until related Shop Drawings have been approved by the Engineer.

D. Do not have products delivered to Site until adequate storage facilities have been provided.

E. Have products delivered to Site in manufacturer's original, unopened, labeled containers. Keep the Engineer informed of delivery of all material to be incorporated in the Work.

F. Partial deliveries of component parts of material shall be clearly marked to identify the material, to permit easy accumulation of parts and to facilitate assembly.

G. Immediately on delivery, inspect shipment to assure:

1. Product complies with requirements of Contract Documents and reviewed submittals.

2. Quantities are correct.

3. Containers and packages are intact, labels are legible.

4. Products are properly protected and undamaged.

2.2 PRODUCT HANDLING

A. Provide equipment and personnel necessary to handle products by methods to prevent soiling or damage to products or packaging.

B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.

C. Handle products by methods to prevent bending or overstressing.

D. Lift heavy components only at designated lifting points.

E. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

PART 3 - EXECUTION

3.1 REMOVING, HAULING, AND INSTALLING EQUIPMENT AND MATERIALS

A. The Contractor shall inspect all items including all boxes, crates and packages containing equipment and materials for damage that may have occurred during shipment prior to its removal from the truck or other conveyance. Any damage shall immediately be reported to the Engineer. The Contractor shall then carefully remove the equipment and materials from the truck or trucks on which it is shipped.

The equipment and materials shall then be transported to the place of installation at the job Site. The Contractor shall be liable for loss or damage that the equipment or materials may receive while being unloaded, transported, stored or installed. The Contractor shall employ competent workers experienced in the installation of the types of materials to be furnished, and shall ensure that all materials are installed in accordance with the recommendations of the manufacturer. All material that arrives at the job Site during normal working hours shall be unloaded as soon as practicable.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 01 71 23

FIELD ENGINEERING

PART 1 – GENERAL

1.1 GENERAL

A. The Contractor will establish benchmarks for use by the Contractor and his subcontractors, all other layout work shall be in accordance with the Contract Documents. The Engineer shall provide the Contractor with an AUTOCAD file of the design drawings for his use.

B. Contractor shall:

1. Provide civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.

2. Develop and make all detail surveys and measurements needed for construction.

3. Provide a transit and leveling instrument, stakes and accessories on the site at all times and a skilled instrument man employed or obtained whenever necessary for layout of the Work.

4. Provide all material required for benchmarks, control points, batter boards, grade stakes, and other items.

5. Be solely responsible for all locations, dimensions and levels. No data other than written order of the Owner shall justify departure from the dimensions and levels required by the Drawings.

1.2 DATUM PLANE

A. All elevations shown on the Contract Plans or specified refer to the Project Datum, which has its benchmark as shown on the Contract Plans.

1.3 CONTRACTOR'S FIELD ENGINEER

A. The Contractor shall employ and retain at the Site of the Work a field engineer and/or superintendent capable of performing all engineering tasks required of the Contractor. Tasks shall include as a minimum:

1. A projection of work to be completed the following day must be submitted to the Engineer by 4:00 p.m. of the preceding work day. This projection must include:

   a. Location of all areas in which construction will be done.

   b. Number of workers required each day

   b. Major construction equipment utilized.

   c. Equipment and materials to be installed.

2. Furnish all required lines and grades for construction operations. Check all formwork, reinforcing, subgrade, asphalt, other materials and equipment.

3. Maintain field office files and drawings, and Record Drawings. Prepare Layout and Coordination Drawings for construction operations.

4. Check and coordinate Work for conflicts and interferences and immediately advise the Engineer of all discrepancies noted.

5. Cooperate with Engineer in field inspections as required.

6. Follow without delay all instructions of the Engineer or assistants in the prosecution and completion of the work in conformity with this Contract. The Contractor's representative shall have full authority to supply labor and materials immediately.

7. The Contractor shall also have a competent representative available to receive telephone messages and provide a reasonable reply as soon as possible, but not later than 24 hours.

1.4 QUALIFICATIONS OF FIELD SUPERINTENDENT

A. Qualified superintendent acceptable to the Engineer and Owner.

1.5 CONTRACTOR COST FOR ENGINEERS SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc. of the equipment and accessories furnished, or as a result of the Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the

Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

B. For all Shop Drawings related to this Contract:

1. The Contractor shall respond to required submittals with complete information and accuracy to achieve required approvals within two submissions. All costs to the Consulting Engineer involved with subsequent submission of the Shop Drawings, Samples or other items requiring approval, will be back charged to the Contractor at a rate of $150 per shop drawing submittal or the actual cost based upon the number of hours to review the submittal times the Engineers' normal billing rate, whichever is greater. These costs shall be deducted from payments due for Work completed by the Contractor. In the event an approved item is requested by the Contractor to be changed or substituted for, all involved costs in the reviewing and approval process will likewise be back charged to the Contractor unless judged by the Engineer that the need for such deviation from previously approved data is beyond the control of the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 -EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of work:

1. This Section specifies all cutting and patching to be completed to execute all cutting and patching, including excavation, backfill and fitting required to:

   a. Remove samples of installed Work as required for testing.

   b. Remove or relocate utilities and pipes installed by others which obstruct the Work to which connections must be made.

   c. Make connections or alterations to new facilities.

   d. Restore all areas to a state equal to that which it was in prior to cutting and restore new Work to the standards of these Specifications.

1.2 SUBMITTALS

A. Prior to cutting which may affect integrity and design function of Project or owner's operations, submit written notice to Engineer, requesting consent to proceed with cutting, including:

1. Identification of Project.

2. Description of proposed Work:

   a. Scope of cutting and patching.

   b. Contractor, Subcontractor or trade to execute Work.

   c. Products proposed to be used.

   d. Extent of refinishing.

   e. Schedule of operations.

   f. Alternatives to cutting and patching, if any.

   g. Designation of party responsible for cost of cutting and patching.

h. Description of impact on traffic and permits required/ obtained if necessary

B. Should conditions of Work, or schedule, indicate change of materials or methods, submit written recommendation to Engineer, including:

1. Conditions indicating change.

2. Recommendations for alternative materials or methods.

3. Submittals as required for substitutions.

C. Submit written notice to Engineer, designating time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until authorized by the Engineer.

D. Provide shoring, bracing and support as required to maintain structural integrity of exposed areas and protect adjacent Work from damage during cutting and patching.

E. Conform to all applicable Specifications for application and installation of materials used for patching.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL

A. Execute cleaning during progress of the Work, at completion of the Work, and as specified herein.

B. Requirements of Regulatory Agencies:

1. In addition to the requirements herein, maintain the cleanliness of the Work and surrounding premises within the Work limits so as to comply with federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of waste materials, debris and rubbish.

C. Scheduling of Cleaning and Disposal Operations: So that dust, wash water or other contaminants generated during such operations do not damage finished surfaces.

1. To prevent accumulation of dust, dirt, debris, rubbish and waste materials on or within the Work or on the premises surrounding the Work.

D. Waste Disposal:

1. Dispose of all waste materials, surplus materials, debris and rubbish off the site.

2. Do not burn or bury rubbish and waste materials on the construction site.

3. Do not dispose of volatile or hazardous wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.

E. Cleaning Materials:

1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

2. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.

3. Use only materials which will not create hazards to health or property.

F. During Construction:

1. The Contractor shall remove and dispose of all debris resulting from work, at least twice a week and more often if same interferes with the work or presents a fire hazard. All debris and excess material shall be removed from the Owner's property. Burying of any debris or excess material within the premises will not be permitted. Burning of same will be strictly forbidden.

2. The Contractor shall provide a dumpster or other approved means of refuse removal for the use.

   a. Dumpster shall be located where directed by the Owner.

   b. Placing of the refuse in the dumpster shall be the responsibility of each individual Contractor.

   c. Dumpster shall be emptied and replaced as required so that refuse may be disposed of as quickly as possible.

3. Keep the work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris and rubbish.

4. Keep dust generating areas wetted down or apply approved dust palliative at no additional cost to the Owner.

5. Dispose of waste, debris and rubbish off Site at legal disposal areas in accordance with local, state and federal codes and regulations.

G. Owners Right to Clean

1. Should the Contractor fail or refuse or neglect to remove rubbish and waste materials and temporary work or clean the buildings and premises as required herein, then the Owner may or shall, without obligation to do so, remove and dispose of said rubbish, waste materials and temporary work, and clean the buildings and premises and deduct the cost thereof from any money due or to become due the Contractor under his Contract.

H. When Project is Completed:

1. Contractor shall clean and maintain the Site in accordance with Division 1, Section 01 77 00, Contract Closeout.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.

2. Project record document submittal.

3. Operating and maintenance manual submittal.

4. Submittal of warranties.

5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

1. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

Advise Owner of pending insurance change-over requirements.

Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.

Deliver tools, spare parts, extra stock, and similar items.

Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.

Complete testing of systems. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Engineer’s final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and

dated by the Engineer.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement.

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions.

2. Spare parts list.

3. Copies of warranties.

4. Wiring diagrams.

5. Recommended "turn around" cycles.

6. Inspection procedures.

7. Shop Drawings and Product Data.

8. Fixture lamping schedule.

1.6 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals.

2. Record documents.

3. Spare parts and materials.

4. Tools.

5. Lubricants.

6. Fuels.

7. Identification systems.

8. Control sequences.

9. Hazards.

10. Cleaning.

11. Warranties and bonds.

12. Maintenance agreements and similar continuing commitments.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1 GENERAL

A. Contractor shall maintain and provide Engineer with Project record documents as specified below except where otherwise specified or defined in the Contract Documents.

1.2 MAINTENANCE OF DOCUMENTS

A. Maintain in Contractor's field office in clean, dry, legible condition complete sets of the following: Contract Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other Modifications of Contract, test records, survey data, Field Orders, and all other documents pertinent to Contractor's Work.

B. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI) unless otherwise approved by Engineer.

1. Make documents available at all times for inspection by Engineer and County representative.

2. Record documents shall not be used for any other purpose and shall not be removed from the office without Engineer's approval.

3. Submit updates with each monthly payment requisition.

1.3 RECORDING UPDATED INFORMATION

A. General:

1. Label each document "PROJECT RECORD" in 2-inch high printed letters.

2. Keep record documents current, and updated at least monthly.

3. Do not permanently conceal any Work until required information has been recorded.

B. Contract Drawings: Legibly mark to record actual construction including:

1. Depths of various elements of foundation in relation to datum.

2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

4. Field changes of dimensions and details.

5. Changes made by Change Order or Field Order.

6. Details not on original Contract Drawings.

C. Specifications and Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order or Field Order.

3. Other matters not originally specified.

D. Shop Drawings: Maintain as record documents and legibly annotate Drawings to record changes made after review.

1.4 FINAL SUBMISSION OF RECORD DOCUMENTS

A. Record Drawings shall be provided by the Contractor in accordance with the General Clauses, Article 53 “Record Drawings.”

B. Submittal:

1. At completion of Project, deliver record documents to Engineer.

2. Accompany submittal with transmittal letter containing:

a. Date.

b. Project title and number.

c. Contractor's name and address.

d. Title and number of each record document.

e. Certification that each document as submitted is complete and accurate.

f. Signature of Contractor, or his authorized representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 02 32 19

EXPLORATORY EXCAVATIONS (TEST PITS)

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation of test pits where it may be necessary to locate or examine soils, groundwater, drains, pipes, rock, utilities, subsurface structures, or any other obstacles or subsurface conditions.

2. Stockpiling, management, and disposal of surplus or unsuitable material.

3. Backfilling and compacting of test pits with suitable material.

B. Exploratory excavations shall be conducted where shown on the Drawings and where directed or approved by the Engineer

C. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

D. Contractor is responsible for all health and safety.

1.2 REFEENCES

A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.

B. United States Code of Federal Regulations (CFR)

1. 29 CFR 1926, Safety and Health Regulations for Construction.

1.3 SAFETY

A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.

B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades etc. shall conform with all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

C. Contractor shall provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.

D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.

E. Any time an excavation is to remain open, at a minimum, the contractor shall provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.4 SUBMITTALS

A. Contractor shall submit record data of observations noted in test pits, including photographs, diagrams, and descriptive notes.

1.5 QUALITY ASSURANCE

A. Contractor shall use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Utility Mark Outs

1. Prior to commencing work, comply with utility mark-out requirements on the Call-Before-You-Dig System (811).

2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.

C. Utility Coordination

1. Inform all utility owners of the necessity of test pit work. Prove reasonable advance notice to allow for coordination.

2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.

3. If so desired by the respective utility owners, all or part of the work under this Section may be accompanied by their crews and/or supervised by them.

D. Utility Protection

1. Safeguard and protect from damage any utility to remain in service. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owner's requirements.

2. Where utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.

3. When uncharted or incorrectly charted piping or utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

E. Retaining Structures

1. Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utilities, paving, light standards, piping or conduit. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

1.6 SEQUENCING

A. Contractor shall provide Engineer a minimum two (2) day notice prior to test pit excavation. Notify Engineer prior to backfill.

B. If test pits are required during the work to evaluate unforeseen conditions, notify Engineer as soon as the need for such work is known.

C. Notify Engineer and/or utility companies of any conflicts or other conditions observed which may require design revisions, relocations, and/or adjustment. No work shall be started within areas where conflicts or other conditions are observed which require design revisions, relocations, and/or adjustment until authorized by the Engineer.

PART 2 - PROCUCTS

2.1 SOILS

A. Refer to Section 31 00 00, Earthwork.

PART 3 – EXECUTION

3.1 EXCAVATION

A. Test pit excavation and backfill shall comply with applicable provisions of earthwork and excavation as indicated in other applicable Specification Sections.

B. Excavation of test pits shall be accomplished by such means as are required to ensure that underground utilities or structures which may be encountered are not damaged.

C. Contractor shall measure and record the size, configuration, exact horizontal and vertical location of all utilities, pipes or other conditions/obstacles encountered.

D. Contractor shall be solely responsible for any damages incurred during excavation operations. Any such damages shall be repaired or replaced by Contractor to the satisfaction of the facility owner/operator, responsible/administering agency, and/or Engineer. Whether repair and/or replacement is conducted by Contractor or must be conducted by owner/operator or responsible/administering agency, any and all costs thereof, including those costs associated with planning, coordination and owner/operator or responsible/administering agency personnel, shall be borne by Contractor.

E. Where an existing pavement has been removed for test pit excavation, the surface shall be restored in accordance with the Drawings and

Specifications. In all other areas, the surface of test pit areas shall be backfilled and the surface restored to a condition equal to original, unless otherwise indicated by the Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. The quantity of test pit excavation to be measured for payment shall be the number of cubic yards of material excavated, as ordered in writing by the Engineer, and as measured in its original position. No measurement for payment will be made for excavation beyond the limits ordered.

4.2 PAYMENT

A. The contract price for test pits shall be the unit price bid per cubic yard for test pit excavation and backfilling and shall cover the cost of labor, materials, plant, equipment, samples, tests and insurance required and necessary to excavate all materials of whatever nature encountered (except excavation of boulders in open cut and ledge rock) as specified or ordered, including the providing of all additional sheeting and bracing; modifications to sheeting systems; pumping; bridging; decking; cleaning up; disposing of surplus and rejected excavated materials; grading and compacting subgrade; and do all work incidental thereto, all in accordance with the Plans, Specifications and Standards, and as directed by the Engineer.

B. When the test pit is located within a paved area, payment shall include furnishing and installation of temporary asphalt pavement.

C. No payment will be made for any test pits performed by the contractor that were not approved in writing by the Engineer prior to excavation.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 02 33 13

UNDERGROUND UTILITY LOCATOR SERVICE

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 71 23, Field Engineering.

1.2 REFERENCES

A. American Society of Civil Engineers, CI/ASCE 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data."

B. American Public Works Association, Uniform Color Code."

1.3 DEFINITIONS

A. Utility Quality Levels:

1. Level A: Precise horizontal and vertical location of utilities obtained by the actual exposure (or verification of previously exposed and surveyed utilities) and subsequent measurement of subsurface utilities, usually at a specific point. Minimally intrusive excavation equipment is typically used to minimize the potential for utility damage. A precise horizontal and vertical location, as well as other utility attributes, is shown on plan documents. Accuracy is typically set to 15-mm vertical and to applicable horizontal survey and mapping accuracy as defined or expected by the project owner.

2. Level B: Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. Quality level B data should be reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances defined by the project and reduced onto plan documents.

1.4 DESCRIPTION

A. Retain an independent utility locator service company to field locate and mark existing underground utilities and service connections. The word "independent" as used above means a person not in the regular employment of the Contractor or having any vested interest in the Contractor's business.

1. Level B locator service shall be performed in all project areas where excavations, regrading of the ground surface, and penetrations of the ground surface are to be performed.

    a. Contractor shall include a minimum of 32 hours of Level A locator service to locate underground utilities as identified on the contract drawings or as identified during the Level B investigation that require more specific location, invert elevation, size, etc. Level A investigation shall only be performed at locations where shown or as directed.

    b. In heavy metal areas, such as near perimeter fences, ground penetrating radar shall be used to determine the location of underground utilities. The use of equipment that induce a tracing signal along the utility path (such as a Metrotech unit) can cause false readings, shall not be used within five feet of fences.

2. The Level A investigation shall be performed as follows:

    a. Hand excavation may be performed for depths of three feet or less.

    b. Vacuum excavation shall be performed at depths greater than three feet.

    c. All excavation test pits shall be backfilled by close of business that day.

3. Support and protect all utilities and service connections to remain in place.

4. The locator service shall field locate and mark underground utilities and service connections prior to excavation.

5. The contractor shall be responsible for coordinating the extent of the areas of subsurface investigation required to locate all underground utilities and service connections in the areas of excavation.

6. All costs associated with the repair of underground utilities and service connections hit/damaged during the investigative work shall be the responsibility of the contractor.

7. Utility location services shall be in accordance with the provisions of CIASCE 38-02, “Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.”

1.5 SUBMITTALS

A. Quality Control Submittals:

1. Submit detailed experience and qualification information about the underground utility locator service company and the persons that will be performing the Work. Detailed experience and qualification information shall include:

a. Minimum of five (5) years experience in field locating, marking and staking out of existing underground utilities and service connections.

1) Qualifying Experience: Project information of 5 similar projects, which the locator service company, had worked on during the past 5 years. Information shall include for each project:

a) Name and Address of project.

b) Dates worked on project.

c) Name and telephone Number of contact person at the project site for which the locator service was performed.

b. Description of types of utility locator equipment (investigation equipment) that company will utilize to perform the underground utility investigation.

c. Names of persons that the persons that will be performing the Work, including the number of years of experience and training that the persons have in the use of the equipment. Include copy of training certificates for locator equipment proving the person performing the locator service are trained on the equipment being used.

2. Submit Quality Control Submittals within 10 days of contract award.

B. Investigative Report:

1. Submit detailed written report and scaled drawings of the subsurface investigation, documenting all underground utilities and service connections located and identified.

a. All documentation shall be referenced to existing data (horizontal and vertical) previously established.

b. Provide three (3) paper copies and one (1) electronic copy of detailed written report and drawings.

2. Submit Investigative Report at least two weeks prior to advancing construction within the scheduled areas of excavation within the project site.

1.6 COORDINATION AND SCHEDULING

A. Coordinate the Work to determine the extent of the areas of subsurface investigation required to locate all underground utilities and service connections in the areas of excavation.

B. Coordinate the Work with the Westchester County personnel to minimize utility disruptions and facility operations. Provide a schedule for the Work required to the Westchester County personnel for approval. Upon approval of the schedule, notify the Westchester County personnel a minimum of three (3) working days prior to performing the Work.

C. Within the areas of excavation, all underground utilities and service connections shall be field located and their locations marked at least two (2) weeks prior to the performance of the required excavation work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 WORK AREAS AND PERFORMANCE

A. If any underground utilities and service connections are hit or damaged during the Work, immediately inform the Engineer for directions on how to proceed.

B. The utility locator service investigative work, field location and marking of underground utilities and service connections and submission of the investigative report must be completed before any excavation work can begin.

1. Contractor shall maintain markings throughout the contract duration or until a time when directed (in writing) by the Engineer that maintaining of the markings are no longer required.

C. Provide subsurface investigation information, detailed written report and drawings of the subsurface investigation, documenting all underground utilities and service connections located and identified, prior to the performance of the required excavation work.

D. If during the Level B investigations, unknown underground utilities are discovered, the Engineer shall be notified as soon as possible or before the close of that business day.

E. Field Marking of underground utilities shall follow the American Public Works Association (APWA) uniform color code:

White: Proposed Excavation.

Pink: Temporary Survey Markings.

Red: Electric power lines, cables, conduit and lighting cables.

Yellow: Gas, oil, steam, petroleum and gaseous material.

Orange: Communications, alarm, signal lines, cables or conduit.

Blue: Potable water.

Purple: Reclaimed water, irrigation and slurry lines.

Green: Sewer and drain lines.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 02 40 00

DEMOLITION, REMOVALS AND MODIFICATIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Contractor shall furnish all labor, materials, equipment and incidentals required for demolition, removals and disposal Work shown, specified and required to complete the project. Included are all modifications of existing facilities as shown and required to complete the Work.

B. Included, but not limited to, are demolition and removals of existing materials, equipment, or work necessary to install the new Work as shown and specified and to connect same with existing work in an approved manner. The Work includes foundations, wooden exterior structures, manholes, piping, power lines, electrical and mechanical equipment, appurtenances, paving, walks, trees, shrubs, utilities and similar existing facilities.

C. Demolitions, removals and modifications which may be specified under other Sections shall conform to requirements of this Section.

D. Protection of site work and adjacent structures.

E. Disconnection, capping and removal of utilities.

F. Dismantled items to be retained by the Owner and to be reinstalled.

G. No explosives are permitted.

H. Related Work Specified Elsewhere:

1. Section 31 00 00, Earthwork

1.2 SUBMITTALS

In accordance with the procedures and requirements set forth in the General Conditions and Division I, the Contractor shall submit the following to the Engineer for approval

A. Schedule: Submit for approval proposed methods, equipment, and operations sequence. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of sewage flow or treatment.

B. Submit selective demolition schedule.

C. Informational Submittals: Submit copies of any notifications, authorizations and permits required to perform the Work. Submit a shipping receipt or bill of lading for all universal waste shipped.

1.3 JOB CONDITIONS

A. Protection

1. Contractor shall execute the demolition and removal Work to prevent damage or injury to structures, existing building services, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.

2. Contractor shall provide interior and exterior shoring, bracing and support to prevent movement, settlement, or collapse of existing structures or facilities. The Owner assumes no responsibility for the actual condition of the structures or facilities adjacent to the Work or the structures or facilities designated for removal or modifications.

3. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the Work by the placement or storage of materials will not be permitted without proper permits and notifications, and all operations shall be conducted with a minimum interference to vehicular or pedestrian traffic.

4. Contractor shall erect and maintain barriers, lights, sidewalk sheds, and other required protective devices.

5. Contractor shall repair damages caused by his operation to facilities to remain, or to any property belonging to the Owner, utilities, or occupants of the facilities.

6. Contractor shall design, erect, install and maintain temporary partitions and enclosures required to eliminate dust, noise and debris from adjacent buildings.

7. The Work shall comply with the applicable provisions and recommendation of ANSI AIO.2, Safety Code for Building Construction, all governing codes and as hereinafter specified.

8. Contractor shall exercise precautions for fire protection. Burning of debris shall not be permitted.

B. Scheduling

1. Contractor shall carry out all operations so as to avoid interference with operations.

2. The Contractor shall proceed with the removal of the equipment, piping and appurtenances in a sequence designed to maintain stormwater and sanitary sewer flows.

3. The Contractor shall be solely responsible for making all necessary arrangements and for performing all necessary work involving the discontinuance or interruption of all utilities or services.

4. Any equipment piping or appurtenances removed without proper authorization, shall immediately be replaced to the satisfaction of the Engineer at no cost to the Owner.

C. Notification

1. At least 48 hours prior to commencement of a demolition or removal, Contractor shall notify the Engineer in writing of his proposed schedule therefore. Owner will inspect the existing equipment and review with the Contractor those items which are to remain the property of the Owner. No removals shall be started without the permission of the Engineer.

D. Explosives

1. Do not bring explosives on site. No explosives will be permitted for this Project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Disposition of Materials and Equipment.

1. All materials and equipment removed from existing work, shall become the property of the Contractor, except for those items which the Owner has identified and marked, to remain the property of the Owner. All materials and equipment so marked by the Owner shall be carefully removed by the Contractor, so as not to be damaged, and shall be cleaned of all solids and stored on or adjacent to the site in a protected place specified by the Owner.

2. Contractor shall dispose of all demolition materials, equipment, debris, and all other items not to remain as property of Owner, off the site and in conformance with all existing applicable laws and regulations.

B. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.

C. Demolition and Removals:

1. Unless otherwise approved by Engineer, proceed with demolition and removals from the top of the structure.

2. Locate, identify, disconnect and seal or cap off utilities in buildings/ structures to be demolished.

3. Demolish concrete and masonry in small sections.

4. Break up and remove foundations and slabs where shown.

5. Locate demolition and removal equipment throughout the structure in such a way and remove materials as frequently as necessary so as to not impose excessive loads to supporting walls, floors or framing.

D. The Contractor, Owner, and Engineer shall jointly survey the condition of the adjoining structures prior to the execution of the work. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims. Photographs shall be taken in accordance with the requirements of the General and Supplementary Conditions.

E. Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities servicing occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

F. Cease operations if public safety or remaining structures are endangered. Perform corrective measures immediately. Notify authority having jurisdiction and the Owner. Do not resume operations until directed by the Owner.

G. Do not damage building/mechanical/electrical elements and improvements indicated to remain.

H. Do not use demolition debris as backfill.

3.2 STRUCTURAL REMOVALS

A. Contractor shall remove concrete and structures to the lines and grades shown unless otherwise directed by the Engineer. Where no limits are shown, the limits shall be 4 inches outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Engineer with no additional compensation to the Contractor.

B. Locate, identify, disconnect and seal or cap off existing utilities in buildings, tanks, chambers and structures to be demolished.

C. Determine the thickness of existing concrete to be removed and the extent to which they are reinforced. No additional compensation will be made because of variations from the thickness shown or for variations in the amount of reinforcement.

D. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Engineer. Demolished items shall not be used in backfill.

E. After removal of parts or all of masonry walls, slabs and like work which tie into new Work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and finished surfaces exposed.

3.3 PAVEMENT, CURB AND SIDEWALK REMOVALS

A. Remove existing pavement and gravel roadway including base and surface courses, stabilized sub-bases, curbs, and gutters as required to construct new facilities or as shown. Before removing, saw a straight joint at least 1-1/2-inches deep between sidewalk and pavement designated for removal and that left in place. Provide neat saw cuts at limits of pavement removal as indicated. Curbs and gutters shall be removed to the nearest construction joint beyond the end of demolition symbol shown on the Contract Drawings.

B. Determine the thickness of existing pavement, base, sub-base, curb, gutter, driveway pavement, and sidewalk to be removed and the extent to which they are reinforced.

No additional compensation will be made because of variations from the thickness shown or for variations in the amount of reinforcement.

C. Provide for satisfactory transition between replaced pavement and sidewalks and the portions remaining in place.

3.4 MISCELLANEOUS REMOVALS

A. Contractor shall remove miscellaneous concrete walls, trees and shrubs, slabs, pipe supports, equipment pads, and curbs where shown on the Drawings or where necessary for the modification of the existing structures. Anchor bolts shall be cut back one inch below the surface and patched.

3.5 MODIFICATIONS AND CLOSURES

A. Modifications shall conform with all applicable Specifications, the Drawings, and the directions and approvals of the Engineer.

B. Where alterations require cutting or drilling into existing floors, walls, and roofs the damages shall be repaired in an approved manner. Contractor shall repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the Engineer. All repairs shall be smoothly finished unless otherwise approved by the Engineer.

C. Openings in existing concrete slabs, ceilings, roofs, masonry walls, floors and partitions which are not to be used in the new Work shall be closed and sealed as shown.

D. All existing structures are to remain in service, demolish the portions to be removed, repair damages, and leave the structure in proper condition for the intended use. Remove concrete and masonry to the lines designated by drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp straight edges that will result in neat joints with new construction or be satisfactory for the purpose intended. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing flush with the surface.

E. New Work shall be keyed into the existing in an acceptable manner. In general, the same or matching materials as the existing adjacent surface shall be used. The finished closure shall be a smooth, tight, sealed, permanent closure with all exposed surfaces smooth finished and acceptable to the Engineer.

F. Where existing reinforcement is to be exposed and incorporated into new concrete work, this reinforcement shall be sand blasted clean of all rust and concrete residue and painted with a zinc-rich primer paint.

3.6 CLEANUP

A. Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste, and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 02 80 00

WASTE TRANSPORTATION AND DISPOSAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish all labor, materials, supplies, equipment, power, facilities and incidentals necessary to label, sample, test, manifest, transport and dispose of all waste and materials generated by the Work, and designated for removal from the site by the Owner, and any other materials as shown on the Contract Drawings and as directed by the Owner.

B. Labeling, sampling, testing, manifesting, transporting and disposing of waste shall be performed in accordance with all applicable federal, state and local laws and regulations, including NYSDEC hazardous waste and transporter regulations (6 NYCRR Parts 364, 370-376) and USEPA PCB TSCA regulations (40 CFR Part 761) and the requirements of the disposal facility.

C. The Contractor shall prepare and issue all notifications and apply for and obtain all permits and approvals required to complete the Work. All fees for licenses, permits, tolls, approvals, taxes, transportation fees, etc. shall be the responsibility of the Contractor.

D. The Work shall be performed in accordance with all the approved submittals.

E. Materials removed from the site shall be transported directly to facilities which have received prior approval of the Owner.

F. Related Work Specified Elsewhere:

1. Section 02 40 00, Demolition, Removals and Modifications.

2. Section 02 83 00, Hazardous Materials Removal.

3. Section 31 00 00, Earthwork

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

A. The Contractor shall provide all required notifications to federal, state and local agencies prior to transporting material off-site. Copies of all notifications issued by the Contractor shall be transmitted to the Engineer at the time of issuance.

B. Contaminated materials removed from the site shall not be combined with non-contaminated material. Material characterized as hazardous waste, if any, shall not be combined with any other material.

C. The Contractor shall be responsible for all sampling and analyses required for disposal. The Contractor shall provide his own data for this purpose. All sampling shall be conducted with the Engineer present. The Contractor shall be required to obtain approval from the Engineer and the Owner of the sampling and analytical methods and the analytical laboratory to be used. The results of all analyses shall be submitted to the Engineer prior to removal of any material from the site. The time and date of collection and sample identification numbers shall be clearly indicated on the results of analyses furnished to the Engineer.

D. The Contractor shall acquire and complete all required manifest forms and bills of lading as required by applicable laws and regulations for transportation and disposal of materials off-site. The Contractor shall provide all required manifests and bills of lading to the Engineer along with all requested backup documentation. The Engineer or Owner's Representative shall sign manifests and bills of lading for the Owner. However, the Contractor shall be responsible for assuring that all notifications, labeling, documentation, sampling, analysis, transportation and disposal requirements of the disposal facility, and federal, state and local requirements are complied with and properly documented. Waste manifests submitted to the Owner and Engineer shall be furnished with a certification signed by the Contractor stating that all requirements of the disposal facility, and federal, state and local governments are complied with.

E. The Contractor shall provide letters of commitment from all disposal facilities to the Engineer. The letters of commitment shall state that the facility is able to accept the waste which the Contractor intends to ship to the facility.

1. Letters of Commitment shall be obtained by the Contractor from all waste haulers and from all transfer, treatment, storage and disposal facilities to which the Contractor intends to ship any and all waste and other materials generated by the Work. The letters of commitment shall specifically identify the types and quantities of waste that the facility will be able to accept from the Contractor, the permit numbers for all facilities at which the waste will be accepted and all waste characterization requirements. In the event that a facility (such as a privately owned treatment works) is prohibited from issuing a letter of commitment without a sample of the waste, a conditional type letter will be acceptable. Such a conditional letter shall specifically state what types and quantities of waste the facility will accept. In addition, the following information shall be submitted:

a. For each waste hauler

1) Name and federal and state identification numbers.

2) Address.

3) Name of responsible contact for the hauler.

4) Telephone number for the contact.

5) List of types and sizes of all transport vehicles and equipment to be used.

6) A description of proposed transportation route, method and procedures for hauling waste material, including type of vehicles that will be used for each type of waste.

7) Copies of any and all necessary permits and authorizations for each type of waste transported, including the transporter's EPA ID Number and Part 364 Permit Number, if applicable.

b. For each transfer, treatment, storage and disposal facility, the Contractor shall submit the following information.

1) General Information:

a) Facility name and federal and state identification numbers

b) Facility location

c) Name of responsible contact for the facility

d) Telephone number for contact

e) Signed letter of commitment to accept waste as specified in this Contract

f) Unit of measure utilized at facility for costing purposes

2) Copies of all permits, licenses, letters of approval, and other authorizations to operate, held by the proposed facility as they pertain to receipt and management of waste derived from this Contract.

3) The Contractor shall identify the unit(s) that the facility will use to manage the waste.

4) The Contractor shall provide the date of the proposed facility's last compliance inspection by all federal, state and local government agencies.

5) List of all active (unresolved) compliance orders (or agreements), enforcement notices, or notices of violation issued to the proposed facility.

6) For all facilities utilized for the disposal of metal coated with or containing lead, the Contractor shall provide all information required by 6 NYCRR Part 371.1(c)(7)(ii).

F. Vehicles used to haul materials shall be designed, equipped, operated and maintained to prevent leakage, spillage or airborne emissions during transport. The containers shall be lined with 10-mil polyethylene sheeting prior to loading, if determined necessary for the given waste type, as determined by the Engineer.

G. Certified weigh tickets showing the weight of the vehicle at the time of arrival and departure from the disposal facility shall be provided as a prerequisite to payment for all material transported off-site. The weight tickets shall be signed and dated by a representative of the Contractor certifying to the accuracy of all measurements, the date and time of arrival and departure of each vehicle, the disposal location and the vehicle identification number.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Waste transportation and disposal will be measured for payment by cubic yard acceptably removed within the lines and allowable tolerances shown on the plans or directed by the Engineer and as measured in place. No measurement for payment will be made for excavation beyond the limits ordered.

4.2 PAYMENT

A. Payment will be at the contract unit price per cubic yard which shall include all cost of labor, furnishing, placing materials, planting, equipment required, sampling, testing, insurance required to excavate all materials of whatever nature encountered (except excavation of rock) as specified or ordered, additional sheeting and bracing, modifications to sheeting systems, pumping, bridging, decking, cleaning up, disposing of excavated materials, grading and compacting of sub-grade, and all work incidental thereto to complete the work as specified herein and in accordance to the contract drawings, specifications and standards, and as directed by the Engineer. No payment will be made for waste transportation and disposal outside the required limits and allowable tolerance.

B. The quantities to be measured for payment shall be as described below.

ITEM #	DESCRIPTION	UNIT
Y	Waste Transportation and Disposal	C.Y.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 02 83 00

HAZARDOUS MATERIALS REMOVAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish all labor, materials, supplies, equipment, power, facilities and incidentals necessary to remove all hazardous materials that will be impacted by the proposed Work, as shown on the Drawings and Exhibit A of this specification, and as specified and as directed by the Engineer. The Contractor shall remove, transport and dispose of all hazardous materials identified in the building in accordance with all applicable federal, state and local regulations. Refer to the Appendix 3 for the hazardous materials assessment report prepared by D&B Engineers and Architects, which formed the basis for the identification and quantification of hazardous materials requiring removal.

B. Note that this specification is only applicable to hazardous materials removals other than asbestos.

C. The Contractor shall remove and properly manage all hazardous materials prior to initiating any demolition activities, unless approval is granted by the Engineer. The Contractor shall furnish all labor, materials, services, insurance, permits and equipment necessary to carry out the proper removal, transportation and off-site disposal of these items in accordance with the requirements set forth in this specification. If the Contractor uses a subcontractor to perform the work required under this Contract, these specifications shall apply to that subcontractor, which shall be referred to as the Hazardous Material Subcontractor. The Contractor's use of a Hazardous Material Subcontractor shall not relieve Contractor of full responsibility for the work to be performed. The requirements included are to be adhered to as they apply to this Contract. The Contractor and subcontractors are responsible for complying with all applicable federal, state and local laws, codes, rules and regulations. Lastly, the quantities of hazardous materials contained in this specification and shown on the Drawings are estimated. The Contractor and its subcontractor shall be responsible for verifying the quantities of hazardous materials and including the management of all such materials in its bid.

D. The project includes work in separate and distinct work areas in the building and/or facilities as described below:

1. Prior to any demolition activities, the Contractor shall utilize appropriately trained workers to perform the required hazardous materials removal. If asbestos is present and the Contractor elects to remove the

specified hazardous materials prior to the performance of asbestos abatement, the Contractor shall utilize only New York State Department of Labor (NYSDOL) asbestos workers for the work, who will be working in the regulated abatement areas.

2. Lead abatement is not required as part of this project. However, Contractor shall ensure that all loads of lead-containing/coated materials to be managed as construction and demolition debris or other manner does not exceed the Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Levels for metals (40 CFR 261.24). In the event that a load exceeds a TCLP Regulatory Level, the load must be managed as hazardous waste in accordance with 40 CFR 260 through 268 and 6 NYCRR 370 through 376. In the event that the lead containing/coated component is composed of metal and the Contractor intends to recycle the material as scrap metal, the Contractor shall submit to the Engineer for review and approval the information required by 6 NYCRR 371.1(c)(7)(ii) prior to the removal of any such material from the site. Lead in paint analytical results are summarized in the hazardous materials assessment report. The Contractor shall perform all work involving lead-containing/coated materials in accordance with OSHA's "Lead in Construction" Rule (29 CFR 1926.62).

3. Contractor shall assume that all fluorescent light ballasts contain over 500 parts per million (ppm) of PCBs, unless the ballasts are labeled "Non-PCB" or similar. All ballasts are to be removed in USDOT-approved 55-gallon drums and recycled pursuant to 40 CFR 761.60-62 and 49 CFR 172.

4. Contractor shall remove and manage all lamps as Universal Waste in approved containers pursuant to the New York State Department of Environmental Conservation's (NYSDEC's) Universal Waste regulations found at 6 NYCRR 374-3.

5. The Contractor shall prepare manifests and/or shipping papers for the waste. The Contractor shall provide prepared manifests and/or shipping papers to the Engineer for review and signature by the Owner or authorized agent.

6. Contractor shall provide sufficient containerized storage or secured stockpiles to allow for testing of the materials after removal, and before disposal, in accordance with the disposal facility's requirements. The Contractor shall have the appropriate permits for the disposal facilities to accept the material. Applicable permits or certification by the disposal facility that they will accept the material throughout the contract time is required.

7. All material shall be transported under bills of lading or manifests approved by the Owner.

8. If, at any time, the Engineer decides that work practices are violating pertinent regulations or, in its opinion, endangering workers or the public, the Engineer will immediately notify the Contractor (followed up in writing) that operations shall cease until corrective action is taken by the Contractor. The Contractor shall take such corrective action before proceeding with the Work. Loss or damage due to Stop Work Order(s) shall be the Contractor's responsibility.

E. Related Work Specified Elsewhere:

1. Section 01 35 29, Health, Safety and Emergency Response Procedures.

2. Section 02 40 00, Demolition, Removals and Modifications.

3. Section 02 80 00, Waste Transportation and Disposal.

1.2 PHASING OF WORK

A. The Contractor shall perform and complete the hazardous material removal activities as directed by the Owner and the Engineer, prior to any demolition activities so as to not commingle the waste streams. The Contractor shall prepare manifests and/or shipping papers for the waste and provide to the Engineer for review and signature by the Owner or authorized agent.

1.3 OWNER TO STOP WORK

A. The Owner and the Engineer shall have the authority to stop the work at any time that a determination is made that conditions are not within Specification and/or applicable regulations. The stoppage of work shall continue until conditions have been corrected to the satisfaction of the Owner and Engineer. Standby time and cost to resolve the problems shall be at the Contractor's expense.

1.4 HEALTH AND SAFETY REQUIREMENTS

This subsection is intended to supplement the requirements of Section 01 35 29 (“Health, Safety and Emergency Response Procedures”).

A. General Description:

1. The Contractor shall be responsible for compliance with the most stringent provisions of the applicable statutes and regulations of the State of New York and the United States, and that, without limitation, the

provisions of the United States Department of Labor Occupational Safety and Health Administration (OSHA) are observed and that the methods of performing the work do not involve undue danger to the personnel employed thereon, the public, and public or private property. Should charges of violation of any of the above be issued to the Contractor in the course of the work, a copy of each charge and resolution thereof, shall immediately be forwarded to the Owner.

2. The Contractor shall provide materials, equipment and training to its workers to ensure their protection from any chemical/biological hazards that may be identified during the course of this work.

3. Physical Hazards: The Contractor shall provide safety equipment and training to its workers to ensure their protection from any physical hazards including but not limited to trip/fall hazards, working at elevation, working on an inclined work area, heat stress, contact with energized (hot) active equipment, noise, overhead bump hazards, and electrical shock that may be present during the Work. Specific requirements include the development and implementation of a site-specific Health and Safety Plan (see Section 01 35 29). Documentation of training in the use of fall and fire protection equipment and methods shall be required for all site personnel. The Contractor shall provide a competent on-site person to supervise the project at all times.

4. Safety Act: The Williams-Steiger Occupational and Safety Health Act (OSHA) of 1970, as amended, shall be strictly complied with during the course of this project. This Act shall govern the conduct of the Contractor's workmen, tradesmen, material men, subcontractors, and visitors to the project site.

5. Accident Prevention: In order to protect the lives and health of his employees, the Contractor shall comply with all pertinent provisions of the latest edition of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc. and shall maintain an accurate record of all accidents which occur during the project. After attending to the injured person(s), the Contractor must immediately report an injury or loss of life to the Owner and Engineer, and a copy of the Contractor's report to his insurer of an accident must be provided to the Owner and Engineer.

6. Emergency Response: The Contractor shall establish an Emergency Response Team made up of members of his work force. Team members shall be trained, organized, and capable of responding in the event of an accident, fire, or other emergency. The Contractor shall designate a site Safety Coordinator to train team members regarding the location and use of site-specific fire/life safety equipment. As a minimum requirement,

members of the Emergency Response Team shall be knowledgeable in standard first aid and CPR techniques, fire extinguisher use, and evacuation procedures.

7. Workmen Protection: The Contractor shall provide and maintain all safety measures necessary to properly protect workmen.

8. Emergency Actions: In an emergency affecting safety or life, the work or an adjoining property, the Contractor, to prevent such threatened loss or injury without special instruction or authorization from the Owner or the Engineer, is hereby permitted to act at his discretion.

9. Hazard Communication Act: The Contractor shall comply with the Hazard Communication Standard promulgated by the Occupational Safety and Health Administration (29 CFR 1910.1200). This program ensures that all employers provide the information and training that employees need to work safely and to design and implement an employee protection program. It also provides necessary hazard information to employees, so they can participate in, and support, the protective measures needed at their workplace. The Contractor shall ensure that labels or other forms of warning are legible in English. The Contractor shall provide employees who speak other languages, as required, to communicate with employees in their language.

1.5 WORK SUPERVISION AND COORDINATION

A. Contractor's Supervisor: From the start of the Work through project completion, the Contractor shall have on-site a responsible and competent supervisor. The Supervisor shall be on-site during all working hours. When the Supervisor must leave the site during the Work, all work must cease unless a replacement Supervisor is present. The Supervisor shall be fluent in speaking and writing English.

B. Quality of Work: The Supervisor shall supervise, inspect and direct the Work competently and efficiently, devoting such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. The Supervisor shall be responsible to see that the Work complies accurately with the Contract Documents, and that all Work is of good quality and workmanship.

1.6 SUBMITTALS:

The Contractor shall submit the following, as noted below, in accordance with the requirements specified in Section 01 33 00, Submittal Procedures.

A. Pre-Project Submittals shall be submitted prior to the performance of any work, as follows:

1. Hazardous Material Removal Work Plan: Provide a detailed written Hazardous Material Removal Work Plan that describes the procedures for the removal, characterization, packaging, loading, transportation and off-site disposal of the hazardous materials identified for disposal. The plan shall include, at a minimum, the following:

   a. Identification of proposed transporters and disposal/recycling facilities for the off-site disposal/reuse of hazardous materials (see Section 02 80 00). The waste to be sent to each disposal facility shall be specified.

   b. Copies of applicable permits for the proposed transporters and disposal/recycling facilities (see Section 02 80 00).

   c. Proposed level of worker training for each type of hazardous material to be removed.

   d. Names and applicable licenses of key personnel.

   e. Proof of appropriate training for workers.

   f. Proof of a current medical surveillance program for all Contractor personnel to work on this project.

   g. Safety Data Sheets (SDS) for any chemicals to be used on this project. All products to be used on this project must have an SDS approved by, the Engineer.

   h. Proposed Detailed Work Schedule

   i. Procedures for the characterization of unknown materials including, but not limited to, sample collection procedures, number of proposed samples and analytical methods.

   j. Proof of experience required by Part 1.11 of this Section.

2. A list that identifies the make, model, truck number and registration plate number of each of the trucks that will transport the material to the off-site facilities. Any change of trucks, or additional trucks, must have prior approval at least 24 hours in advance.

3. Results of all analytical sampling data and complete copies of all chain-of-custody forms shall be provided to the Owner at the completion of the work, unless specified otherwise.

B. During Work Submittals:

1. Schedule of Work Change: Any changes in the Schedule of Work proposed by the Contractor shall be submitted for approval no later than seven days prior to the commencement date of the proposed change.

2. A certified, signed, and completed copy of each waste shipment record form used, and receipts from the off-site disposal or recycling facility which acknowledge the Contractor's delivery(s) of material, shall be submitted to the Engineer and Owner within thirty days following removal of hazardous materials from the site.

C. Post Project Submittals:

1. A notarized "Release of Liens" in a form acceptable to the Owner. The Contractor shall use the Standard AlA form. Such notarized release of all liens shall certify that all subcontractors, labor suppliers, etc., have been paid their pro rata share of all payments to date, that the Contractor has no basis for further claim, and will not make further claim for payment in any account after the first payment is made to him.

2. Compilation of all completed and signed waste shipment record forms, bills of lading or disposal/recycling receipts pertaining to this project.

3. Contractor shall submit the following items as part of its final submittals: Paid invoice verifications for subcontractor, service contract agreement, insurance certificates, copies of the worker licenses, if required, and other submittals required for the Specification.

1.7 FIRE PROTECTION AND EMERGENCY EGRESS

A. The Contractor shall be responsible for the security and safeguarding of all areas turned over by the Owner to the Contractor. The Contractor shall identify to his workers and other building occupants the means of egress in case of emergency.

B. The Contractor shall establish emergency and fire exits from the work area. First aid kit, protective clothing and respirators shall be provided for use by qualified emergency personnel.

1.8 CLEANUP

A. Final Site Cleaning: Upon completion of the work, the Contractor shall remove all temporary construction, decontamination facilities, and unused materials placed on-site by the Contractor; leave the premises in a neat and clean condition; and perform all sweeping, cleaning and washing required to restore the condition of the site to its original condition.

1.9 CODES, PERMITS AND STANDARDS

A. The Contractor shall be solely responsible for compliance with all applicable federal state and local laws, ordinances, codes, rules and regulations that govern the removal, characterization, storage, transportation and off-site disposal or recycling of the hazardous materials listed in the Contract Documents. The current issue of each document shall govern. All work shall comply with all applicable codes and regulations as amended. The applicable regulations for the removal, characterization, storage, transportation, and off-site disposal and/or recycling of the hazardous materials include, but may not limited to, the following:

Code of Federal Regulations (CFR)

1. 29 CFR 1910, Occupational Safety and Health Regulations for General Industry
2. 29 CFR 1926, Occupational Safety and Health Regulations for Construction
3. 40 CFR 261, Identification and Listing of Hazardous Wastes
4. 40 CFR 262, Standards Applicable to Generators of Hazardous Waste
5. 40 CFR 263, Standards Applicable to Transporters of Hazardous Waste
6. 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
7. 40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
8. 40 CFR 268, Land Disposal Restrictions
9. 40 CFR 302, Designation, Reportable Quantities and Notification
10. 40 CFR 355, Emergency Planning and Notification
11. 40 CFR 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

12. 49 CFR 171-179, Hazardous Materials Transportation Act

Codes, Rules and Regulations of the State of New York (NYCRR) Title 6

1. Part 360, Solid Waste Management Facilities General Requirements
2. Part 361, Material Recovery Facilities
3. Part 362, Combustion, Thermal Treatment, Transfer and Collection Facilities
4. Part 363, Landfills
5. Part 364, Waste Transporters
6. Part 365, Regulated Medical Waste and Other Infectious Wastes
7. Part 370, Hazardous Waste Management
8. Part 371, Identification and Listing of Hazardous Wastes
9. Part 372, Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities
10. Part 373, Treatment, Storage, and Disposal Facilities
11. Part 374-2, Standards for the Management of Used Oil
12. Part 374-3, Standards for the Management of Universal Wastes
13. Part 376, Land Disposal Restrictions
14. Part 380, Prevention and Control of Environmental Pollution by Radioactive Materials
15. Part 381, Transporters of Low-Level Radioactive Waste
16. Part 596: Hazardous Substance Bulk Storage Facility Registration
17. Part 597: Hazardous Substances Identification, Release Prohibition, and Release Reporting
18. Part 598: Handling and Storage of Hazardous Substances
19. Part 613: Petroleum Bulk Storage

B. Where conflict among requirements or with these specifications exists, the more stringent requirements shall apply.

C. Permits, State Licenses and Notifications: The Contractor shall be responsible for obtaining necessary permits, licenses and certifications of personnel in conjunction with removal, hauling and disposition of hazardous materials and shall provide timely notification of such actions as may be required by federal and state authorities. Fees and/or charges for these licenses, permits and notifications shall be paid by the Contractor. Contractor shall use all notification forms where applicable.

1.10 TERMINOLOGY

A. The following commonly used terms are defined in the context of these specifications:

1. Authorized Visitor: Representatives of any regulatory or other agency having jurisdiction over the project.

1.11 REQUIREMENTS AND QUALIFICATIONS

A. Minimum Experience: The Contractor shall have a minimum of 3 years experience with removal of hazardous materials, as evidenced through participation in at least three projects of comparable complexity to this project.

B. Experience and Training: All personnel shall at a minimum receive information and training with regards to the hazardous materials in these specifications, as per OSHA 29 CFR, 1910.1200(h). Additional training requirements are as follows:

1. Workers shall have appropriate training for lead exposure, as specified by OSHA in Lead Exposure in Construction (29 CFR Part 1926).

2. Workers shall have NYSDOL asbestos worker certifications unless asbestos abatement is not required or has been completed prior to hazardous material removals. Proof of such experience shall be submitted upon request by the Owner. Improperly trained, untrained or inexperienced personnel shall not be allowed in the work area(s). Personnel shall meet minimum training and experience requirements outlined in this Section.

3. All workers engaged in the removal of hazardous waste shall be 40-hour OSHA hazardous waste training per OSHA 29 CFR 1910.120(e)(3).

1.12 TESTING AND INSPECTION REQUIREMENTS AND RESPONSIBILITIES

A. Visual inspections will be performed by the Owner or Engineer during and after removal of hazardous materials to document compliance with these specifications.

1.13 QUALITY ASSURANCE

A. Qualifications

1. Companies specializing in performing the Work of this Section shall have a minimum of 3 years experience and shall have worked on 3 projects of similar size.

2. The work shall be performed by OSHA-certified workers, who are experienced in handling petroleum-contaminated material, hazardous materials and hazardous wastes.

B. Regulatory Requirements

1. Work of this Section shall conform to all requirements of all applicable regulations of governmental authorities having jurisdiction, including safety, health and anti-pollution regulations. Where more severe requirements than those contained in the Building Code or other applicable regulations are given in this Section, the requirements of this Section shall govern.

2. Work outside the street line shall conform to the requirements of the governmental authorities or utilities having jurisdiction (e.g., DOT, DEC, etc.). Where more severe requirements than those contained in the applicable regulations are given in this Section, the requirements of this Section shall govern.

3. The Contractor shall conform to the requirements of OSHA's Hazardous Waste Operations and Emergency Response, as required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PROTECTION

A. All Contractor personnel shall wear personal protective equipment and protective clothing consistent with the level of protection required for this work as specified by OSHA and the site-specific health and safety plan.

B. The Contractor shall be responsible for the safety of its operation, and for any damage that may result from the Contractor's work. Erect and properly maintain at all times, as required by the conditions and progress of the work, proper safeguards for the protection of workers and the public and post danger

warnings as required by law or otherwise required by the Contract Documents regarding hazards created by the Contractor's operation. Furnish, install and remove after completion of the work, all signs, lights, barricades, fencing and other equipment as may be necessary for the safe execution of the Work.

3.2 DISPOSAL OF HAZARDOUS WASTES

A. Description of Work: All hazardous wastes (as defined in 40 CFR 261 and 6 NYCRR 371) shall be transported to an off-site disposal facility meeting the requirements of 40 CFR 264.

1. Hazardous Wastes: The Contractor shall stage hazardous wastes at the site pending off-site disposal for no longer than 90 days from the date of generation. The Contractor shall contract with an approved off-site disposal facility meeting the requirements of 40 CFR 264 or 6 NYCRR 373. The Contractor shall provide the Owner with original copies of all manifests, weigh tickets and original invoices.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

EXHIBIT A

LIST OF HAZARDOUS MATERIALS (1)

SUMMARY OF SUSPECT PCB-CONTAINING ITEMS		
Waste Type	Location	Approximate Quantity
Ballasts	Tower Road Backflow Preventor Building	4

SUMMARY OF UNIVERSAL WASTE		
Waste Type	Location	Approximate Quantity
Fluorescent Bulbs	Tower Road Backflow Preventor Building	8

1. Reference: Hazardous Materials Assessment Report.

NO TEXT ON THIS PAGE

SECTION 03 11 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 013300, Submittals

B. Section 017400, Construction Waste Management

C. Section 032100, Steel Concrete Reinforcement

D. Section 033000, Cast-In-Place Concrete

1.2 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of Specifications for Structural Concrete for Buildings ACI 301-16 of the American Concrete Institute.

1.3 DESIGN REQUIREMENTS

A. The formwork shall be designed for loads, lateral pressure, and allowable stresses outlined in Chapter 4 - Design of "Guide to Formwork for Concrete" (ACI 347-14).

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation/application instructions for the following:

1. Form systems and ties.

2. Textured (architectural) form linings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chamfer Strips: Wood, metal, PVC or rubber; 1-inch chamfer, unless otherwise indicated on the Drawings.

PART 3 - EXECUTION

3.1 PREPARATION OF FORM SURFACES

A. Apply form-coating material in accordance with manufacturer's instructions.

3.2 INSTALLATION

A. Provide chamfer on all exposed external corners of concrete.

B. Provisions for Work of Related Contracts: Provide openings in concrete formwork to accommodate Work of related contracts. Obtain information for size and location of openings, recesses and chases from contractor requiring such items.

C. Shores and Supports:

1. Concrete members subject to additional loads during construction shall be shored in such a manner as will protect the member from damage by the loads.

2. Do not remove shores until the member supported has acquired sufficient strength to safely support its weight and any weight imposed thereon.

3.3 REMOVAL OF FORMS

A. Forms and shoring used to support the weight of concrete in beams, slabs and other structural members shall be removed in accordance with recommendations in paragraph 3.2.5 of "Recommended Practice for Concrete Formwork" (ACI 347-14).

B. All formwork shall be removed after the concrete has sufficiently hardened, except in inaccessible spaces where approved.

C. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 3/4 inch from the formed surfaces of concrete.

3.4 RE-USE OF FORMS

A. Split, frayed, delaminated or otherwise damaged form facing material shall not be used.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related

work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete reinforcing.

2. Extent of concrete reinforcing is shown and indicated in the Contract Documents.

3. Work includes fabrication and placement of reinforcing including bars, ties, and supports, and welded wire fabric for concrete, encasements, and fireproofing.

B. Related Sections:

1. Section 01 33 00, Submittal Procedures

2. Section 01 74 00, Cleaning and Waste Management

3. Section 04 20 00, Unit Masonry Construction.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ACI 301, Specifications for Structural Concrete.

2. ACI 315, Details and Detailing of Concrete Reinforcement.

3. ACI 350.5, Specifications for Environmental Concrete Structures.

4. ANSI B212.15, Cutting Tools – Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.

5. ANSI/AWS D1.4, Structural Welding Code - Reinforcing Steel.

6. ASTM A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.

7. ASTM A185, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

8. ASTM A615, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

9. ASTM A706, Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

10. ASTM A767, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

11. ASTM A775, Specification for Epoxy-Coated Steel Reinforcing Bars.

12. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.

13. Concrete Reinforcing Steel Institute (CRSI), CRSI 1MSP, Manual of Standard Practice.

14. ASTM E488, Test Methods for Strength of Anchors in Concrete and Masonry Elements.

15. ICC Evaluation Service (ES) AC 308, Acceptance Criteria for Post-Installed Anchors in Concrete Elements.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Testing Laboratory: Shall meet requirements of ASTM E329 and shall have experience in the testing welded splices of reinforcing steel and tension testing of reinforcing bars set in adhesive in hardened concrete.

2. Installer of Adhesive Dowels: Shall be experienced and certified by manufacturer of adhesive as possessing necessary training for installing manufacturer's products. Distributors or manufacturer's representatives shall not provide product training unless qualified as certified trainers by anchor manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI 301 and ACI 350.5.

b. For walls, show elevations at minimum scale of 1/4-inch to one foot.

1) Elevations shall show all openings and reference details that identify additional reinforcing required around each opening.

2) Elevations shall denote each wall intersection and reference a detail that identifies additional reinforcing required at wall intersection. As an alternate to providing separate details for each wall intersection, provide overall plan detailing only the additional wall intersection reinforcing for each wall intersection.

c. For slabs and mats, show top and bottom reinforcing on separate plan views.

1) Plans shall show all openings and shall reference details that identify additional reinforcing around each opening.

d. Show bar schedules, stirrup spacing, diagrams of bent bars, location of bar splices, length of lap splices, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing unless otherwise noted.

e. Provide plans and elevations detailing location, spacing, and lengths of masonry wall dowels, where masonry is required. Coordinate location of dowels with masonry openings and with standard modular spacing. Submit masonry wall dowels with reinforcing submittal for element into which masonry dowel will be embedded. Coordinate with Section 042000, Unit Masonry Construction.

f. Splices shall be kept to a minimum. For slabs and beams, when splices are required, locate spices in bottom bars within 1/3 span from supports and for top bars locate splices in the middle 1/3 of the span.

g. Drawings detailing location of all construction and expansion joints, shall be submitted and approved before Shop Drawings for reinforcing are submitted.

h. Drawings detailing location, spacing, edge distance, and embedment depth of adhesive dowels. Adhesive system shall be submitted and approved before Shop Drawings with adhesive dowels are submitted.

2. Product Data:

a. Manufacturer’s product data for adhesive, if not submitted under other Sections.

b. Adhesive manufacturer's test data and ICC ES report to verify specified capacity of adhesive dowels.

B. Informational Submittals: Submit the following:

1. Certificates:

a. Steel manufacturer's certificates of mill analysis, tensile, and bend tests for reinforcing steel.

b. Certification of welders and weld procedures for splices.

c. Adhesive manufacturer's certification verifying that installer is qualified and using proper installation procedures.

2. Manufacturer's Instructions:

a. Installation instructions for adhesive systems.

3. Field Quality Control Submittals:

a. Reports of all field quality control testing, where applicable.

b. Results of required inspection of welded splices of reinforcing bars.

c. Results of required tensile testing of adhesive dowels. Include size and location of bars tested.

4. Special Procedure Submittals; Description of reinforcing weld locations and weld procedures.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.

B. Store concrete reinforcing products to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: Shall be deformed in accordance with ASTM A615, and as follows:

1. Provide Grade 60 for all bars, unless indicated otherwise.

2. Epoxy-coated reinforcing bars, where required, shall be in accordance with ASTM A775.

3. Galvanized reinforcing bars, where required, shall be in accordance with ASTM A767.

B. Mechanical Couplers: Reinforcement bars may be spliced with mechanical connection upon approval by the Engineer. Connection shall be full mechanical connection that shall develop in tension or compression, as required, at least 125 percent of specified yield strength (fy) of bar. Where splices at the face of wall are shown or approved by Engineer, form saver-type mechanical couplers may be used. Form-saver couplers shall have integral plates designed to positively connect coupler to formwork.

C. Steel Wire: Shall be in accordance with ASTM A82.

D. Welded Smooth Wire Fabric: Shall be in accordance with ASTM A185.

1. Furnish in flat sheets, not rolls.

E. Column Spirals: Hot-rolled rods for spirals, conforming to ASTM A615.

F. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing in place.

1. Use wire bar type supports complying with CRSI 1 MSP recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.

2. For slabs on grade, use precast concrete blocks, four inches square in plan, with embedded tie wire as specified by CRSI 1 MSP. Precast concrete blocks shall have same or higher compressive strength as specified for concrete in which they are located.

3. For concrete surfaces where legs of supports are in contact with forms, provide supports complying with CRSI 1 MSP as follows:

a. At formed surfaces in contact with soil, weather, or liquid, or located above liquid, supports shall be CRSI Class 1 for maximum protection. Plastic coating on legs shall extend at least 0.5-inch upward from form surface. At surfaces not exposed to view or liquid, precast concrete blocks, three inches square in plan, with embedded tie wire shall be permitted. Precast concrete blocks shall have same or higher compressive strength as specified for concrete in which they are located.

b. At interior dry surfaces (not located above liquid), supports shall be either Class 1 or Class 2 for moderate protection.

c. At formed surfaces with an architectural finish, use stainless steel protected legs (Type B).

4. Over waterproof membranes, use precast concrete chairs.

5. For epoxy-coated reinforcing, use wire reinforcing supports coated with dielectric material including epoxy or another polymer for minimum distance of two inches from point of contact with epoxy-coated reinforcement.

G. Adhesive Dowels:

1. Dowels:

a. Dowel reinforcing bars shall be deformed in accordance with ASTM A615, Grade 60.

2. Adhesive:

a. Requirements for adhesive are specified in drawings.

2.2 FABRICATION

A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 301, ACI 315 and ACI 350.5. In case of fabricating errors, do not re-bend or straighten reinforcing in manner that injures or weakens material.

B. Unacceptable Materials: Reinforcing with one or more of the following defects is not allowed:

1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.

2. Bends or kinks not shown on approved Shop Drawings.

3. Bars that do not meet or exceed their ASTM specification requirements when hand-wire-brushed, with respect to cross section, nominal weight, or average height of deformations.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine the substrate and conditions under which concrete reinforcing is to be placed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable requirements of Laws and Regulations, applicable standards, and ACI 301, ACI 315 and ACI 350.5 for details and methods of reinforcing placement and supports.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

1. Place reinforcing to obtain minimum concrete coverages specified in the Contract Documents. Arrange, space, and securely tie bars and bar supports together with 16-gage galvanized wire to hold reinforcing accurately in position during concrete placing. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

2. Prior to placing concrete, using surveyor's level or string line, demonstrate to Engineer that specified cover of reinforcing has been attained.

3. Do not secure reinforcing steel to forms with wire, nails, or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.

D. Allowable Placing Tolerances: Comply with ACI 301, ACI 315 and ACI 350.5, except as specified in this Section:

1. Concrete surfaces in contact with liquid shall have minimum of two inches of concrete over reinforcing steel.

E. Provide sufficient number of supports of strength required to carry reinforcing. Do not place reinforcing bars more than two inches beyond last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Lap Splices:

1. Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars as shown on the Drawings.

G. Install welded wire fabric in lengths as long as practical. Lap adjoining pieces at least one full mesh and lace splices with 16-gage wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

H. Mechanical Couplers:

1. Mechanical butt splices shall be in accordance with recommendations of mechanical splicing device manufacturer. Butt splices shall develop 125 percent of specified minimum yield tensile strength of spliced bars or of smaller bar in transition splices. Bars shall be flame-dried before butt splicing. Provide adequate jigs and clamps or other devices to support, align, and hold longitudinal centerline of bars being butt spliced in straight line.

I. Welded Splices:

1. When field welding of reinforcing is required on the Drawings or allowed by Engineer in writing, welding of reinforcing bars shall conform to ANSI/AWS D1.4. Preheating and rate of cooling requirements shall be based on bar steel chemistry and ANSI/AWS D1.4. Welded splices shall be sized and constructed to transfer minimum of 125 percent of specified minimum yield tensile strength of spliced bars or of smaller bar in transition splices. Unless otherwise allowed by ENGINEER in writing, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.

2. Welding of wire to wire, and of wire or welded wire fabric to reinforcing bars or structural steels, shall conform to applicable provisions of ANSI/AWS D1.4 and Engineer's requirements for the particular application.

3. After completing welding on coated reinforcing bars, repair coating damage as specified in this Section. Welds and steel splice members, when used to splice bars, shall be coated with same material used for repair of coating damage.

J. Adhesive Dowels:

1. Comply with manufacturer's written installation instructions and requirements of this Section.

2. Drill holes to adhesive system manufacturer's recommended drill bit diameter and to specified depth. Drill holes in hammering and rotation mode with carbide-tipped drill bits complying with tolerances indicated in ANSI B212.15. Core-drilled holes shall not be permitted.

3. Before setting adhesive dowel, hole shall be made free of dust and debris by method recommended by adhesive system manufacturer. Brush the hole with adhesive system manufacturer-approved brush and blow hole clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.

4. Before injecting adhesive, obtain Engineer's concurrence that hole is dry and free of oil and other contaminants.

5. Prior to injecting adhesive into the drilled hole, dispense to an appropriate location for waste an initial amount of adhesive from the mixing nozzle until adhesive is a uniform color, indicating that product is properly mixed.

6. Inject adhesive into hole through injection system-mixing nozzle and extension tubes (as required) placed to bottom of hole. Withdraw nozzle's discharge end as adhesive is placed while keeping nozzle immersed to prevent formation of air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placing.

7. Twist dowel during insertion into partially-filled hole to ensure full wetting of rod surface with adhesive. Insert rod slowly to avoid developing air pockets.

8. Provide adequate curing in accordance to adhesive system manufacturer's requirements prior to continuing with adjoining or adjacent Work that could impose or impart load on the dowels. Do not begin adjoining or adjacent Work until dowels are successfully tested or when approved by Engineer.

9. Limitations:

   a. Installation Temperature: Comply with manufacturer's instructions for installation temperature requirements. Provide temporary protection and other measures, such as heated enclosures, necessary to ensure that base material temperature complies with requirements of adhesive systems manufacturer during installation and adhesive system curing.

   b. Oversized Holes: Advise Engineer immediately if size of drilled hole is larger than recommended by adhesive system manufacturer. Cost of corrective measures, including but not limited to redesign of dowels due to decreased capacities, shall be paid by Contractor.

3.3 FIELD QUALITY CONTROL

A. Site Inspections and Tests:

1. General:

   a. Do not place concrete until reinforcing is inspected, and permission for placing concrete is granted by Engineer. Concrete placed in violation of this provision will be rejected.

   b. Do not close up formwork for walls and other vertical members until reinforcing is inspected, and permission for placing concrete is

granted by Engineer. Concrete placed in violation of this provision will be rejected.

c. Correct defective Work by removing and replacing or correcting, as required by Engineer.

d. Contractor shall pay cost of corrections and subsequent testing required to confirm integrity of post-installed anchors.

e. Owner's testing laboratory will submit test results to Contractor and Engineer within 24 hours of completion of test.

2. Site Tests:

a. Contractor will retain the services of an approved independent testing laboratory to perform field quality testing of adhesive dowels at the Site.

1) Testing shall comply with ASTM E488.

2) Test at least ten percent of each type of adhesive dowel. If one or more dowels fail the test, Contractor shall pay cost to test all dowels of same diameter and type installed.

3) Test dowels to 60 percent of specified yield strength. Engineer will direct which dowels are to be tested.

4) Apply test loads with hydraulic ram.

5) Displacement of dowels shall not exceed D/10, where D is nominal diameter of dowel.

3. Inspection of Welded Splices: Owner will employ testing laboratory to perform field quality control testing of welded splices. All welded splices shall be visually inspected. Radiographically test minimum of five percent of butt splice welds. Repair defective welds so that welds are completely sound.

B. Manufacturer's Services:

1. Provide qualified adhesive manufacturer's representative at the Site during initial installation of adhesive dowel systems to train installing personnel in proper selection and installation procedures. Manufacturer's representative shall observe to verify that installer demonstrates proper installation procedures for adhesive dowels and adhesive material. Each installer shall be certified in writing by manufacturer as qualified to install adhesive anchors.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00, Submittal Procedures

B. Section 01 74 00. Cleaning and Waste Management

C. Section 03 11 00, Concrete Formwork

D. Section 03 20 00, Concrete Reinforcing

E. Section 07 26 13, Vapor Retarder Under Slabs on Grade

1.2 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) documents.

1. ACI 301-05: Specification for Structural Concrete for Buildings.

2. ACI 302.1R-04: Guide for Concrete Floor and Slab Construction.

3. ACI 302.2R-06: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

4. ACI 304.2R-96: Placing Concrete by Pumping Methods.

5. ACI 305R-10: Hot Weather Concreting.

6. ACI 306R-10: Cold Weather Concreting.

7. ACI 308.1-11: Standard Specification for Curing Concrete.

8. ACI 318 -05 Building Code Requirements for Structural Concrete.

9. ASTM C 94/C 94M – 11b: Standard Specification for Ready- Mixed Concrete.

10. ASTM C 494/C 494M - 11: Standard Specification for Chemical Admixtures for Concrete.

11. ASTM F 710- 11: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

12. ASTM C 311, Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

13. ASTM C 989, Ground Granulated Blast-Furnace Slag for Use in Concrete Mortars.

14. Standard Practice ACI 226.R1, Ground Granulated Blast-Furnace Slag as a Cementitious Constituent in Concrete.

1.3 DEFINITIONS

A. ACI 301, Section 1.2 - Definitions:

1. Add the following definitions:

a. Cementitious Material: Cementitious materials include cement, ground blast furnace slag and fly ash.

b. Corrosion Inhibitor Admixture: A liquid admixture, calcium nitrite that inhibits corrosion of concrete-embedded steel in the presence of chloride ions.

c. Pumped Concrete: Concrete that is conveyed by pumping pressure through rigid pipe or flexible hose.

d. Water-to-Cementitious Ratio (w/c): A ratio representing quantity in pounds of free moisture available for cement hydration divided by quantity of cementitious materials in pounds per cubic yard concrete.

1.4 SUBMITTALS

A. Submittals Package: Submit product data for design mix(es) and materials for concrete specified below at the same time as a package.

B. Product Data:

1. Mix Design: Submit proposed concrete design mix(es) together with name and location of batching plant at least 28 days prior to the start of concrete work.

a. Include test results of proposed concrete proportions based on previous field experience or laboratory trial batches in accordance with ACI 301, Section 4.

b. Pumped Concrete: Include test results of proposed design mix(es) tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.

2. Portland Cement: Brand and manufacturer's name.

3. Fly Ash: Name and location of source, and DOT test numbers.

4. Air-entraining Admixture: Brand and manufacturer's name.

5. Water-reducing Admixture: Brand and manufacturer's name.

6. High Range Water-reducing Admixture (Superplasticizer): Brand and manufacturer's name.

7. Corrosion Inhibitor Admixture: Brand and manufacturer's name.

8. Accelerating Admixture: Brand and manufacturer's name.

9. Aggregates: Name and location of source, and DOT test numbers.

10. Lightweight Coarse Aggregates: Brand and manufacturer's name.

11. Chemical Hardener (Dustproofing): Brand and manufacturer's name, and application instructions.

12. Chemical Curing and Anti-Spalling Compound: Brand and manufacturer's name, and application instructions.

13. Bonding Agent (Adhesive): Brand and manufacturer's name, and preparation and application instructions.

14. Expansion Joint Fillers: Brand and manufacturer's name.

15. Waterstop: Brand and manufacturer's name, and installation instructions.

C. Quality Control Submittals:

1. Batching Plant Records: At the end of each day of placing concrete, furnish the Director's Representative with a legible copy of all batch records for the concrete placed.

2. Concrete Pumping Equipment Data: Include manufacturer's name and model of principal components, type of pump, and type and diameter of pipe/hose.

3. Minutes of the previous pre-installation conference.

1.5 QUALITY ASSURANCE

A. Qualifications of Crew Pumping Concrete: Workers pumping concrete shall have had at least one year of experience pumping concrete.

B. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation.

C. Truck mixers for concrete shall be currently approved by the New York State Department of Transportation.

D. Pumping equipment for pumped concrete shall be subject to the approval of the Director.

E. Fly ash supplier shall be on the New York State Department of Transportation's current "Approved List of Suppliers of Fly Ash".

F. Source Quality Control: The Director reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:

1. Batching and mixing facilities and equipment.

2. Sources of materials.

G. ACI 301, Section 1.3 Reference standards and cited publications:

1. Add the following to the list of ASTM Standards:

a. C 311-11a Standard Methods of Sampling and Testing Fly Ash or Natural Pozzolans For Use as A Mineral Admixture in Portland Cement Concrete.

1.6 DELIVERY

A. ASTM C 94/C 94M, Article 14 - Batch Ticket Information: In addition to the information required by Paragraph 14.1, also include the following:

1. Type and brand, and amount of cement.

2. Weights of fine and coarse aggregates.

3. Class and brand, and amount of fly ash (if any).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C 150, Type II Portland cement.

B. Water: Potable

C. Air-entraining Admixture: ASTM C 260, and on the New York State Department of Transportation's current "Approved List".

D. Water-reducing Admixture: ASTM C 494/C 494M, Type A, and on the New York State Department of Transportation's current "Approved List".

E. High Range Water-reducing Admixture (Superplasticizer): ASTM C 494/C 494M, Type F, and on the New York State Department of Transportation's current "Approved List".

F. Corrosion-Inhibiting Admixture: ASTM C 494/C 494M, for use in resisting corrosion of steel reinforcement.

1. DCI Corrosion Inhibitor by W. R. Grace & Co., - Conn., 62 Whittemore Ave., Cambridge, MA 02140, (617) 876-1400 and Rheocrete CNI by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

2. DCI - S Corrosion Inhibitor by W. R. Grace & Co., - Conn., 62 Whittemore Ave., Cambridge, MA 02140, (617) 876-1400.

G. Retarding Admixture: ASTM C 494, Type D, Water-reducing and retarding, for use in hot weather concreting, and on the New York State Department of Transportation's current "Approved List".

H. Accelerating Admixture: Non-corrosive admixture, containing no chloride, complying with ASTM C 494, Type C or E, and on the New York State Department of Transportation's current "Approved List".

I. Fly Ash: ASTM C 618, including Table 1 (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.

J. ACI 301, Section 4.2.1.2 - Aggregates:

1. Add the following paragraph:

a. Fine aggregate for pumped concrete shall meet the requirements of ASTM C 33, except 15 to 30 percent shall pass the No. 50 sieve and 5 to 10 percent shall pass the No. 100 sieve. The fineness modulus

of the fine aggregate for pumped concrete shall not vary more than 0.20 from the average value used in proportioning.

K. Moisture-Retaining Cover: Waterproof paper, polyethylene film, or polyethylene-coated burlap complying with ASTM C 171.

L. Chemical Curing and Anti-Spalling Compound: ASTM C-309, Type 1D, Class B, with a minimum 18 percent total solids content. No thinning of material allowed.

1. SureCure Emulsion, Kaufman Products, Inc. 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.

2. Cure & Seal by Symons Corp., 200 East Touhy Ave., PO Box 5018, Des Plaines, IL 60017-5018, (847) 298-3200.

3. Kure-N-Seal by Sonneborn/ BASF Building Systems, 889 Valley Park Dr., Shakopee, MN 55379, (800) 433-9517.

4. Day-Chem Cure & Seal UV 26 percent (J-22 UV) by Dayton Superior Corp., 721 Richard St., Miamisburg, OH 45342, (800) 745-3700.

5. Acrylseal HS by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

M. Chemical Hardener (Dustproofing): Colorless aqueous solution of magnesium-zinc fluosilicate.

1. Lapidolith by Sonneborn/ BASF Building Systems, 889 Valley Park Dr., Shakopee, MN 55379, (800) 433-9517.

2. Surfhard by The Euclid Chemical Co., 19218 Redwood Rd., Cleveland, OH 44110, (216) 531-9222.

3. Pena-Lith by W.R. Meadows, Inc., PO Box 543, Elgin, IL 60121, (847) 683-4500.

4. FluoHard by L & M Construction Chemicals, Inc., 14851 Calhoun Rd., Omaha, NE 68152, (402) 453-6600.

5. Armortop by Anti Hydro International, Inc., 265 Badger Ave., Newark, NJ 07108, (800) 777-1773.

6. Diamond by Kaufman Products , Inc., 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.

N. Type 1 Expansion Joint Filler: Preformed, resilient, nonextruding cork units complying with ASTM D 1752, Type II.

O. Epoxy Bonding Agent (Adhesive): 100 percent solids epoxy-resin-base bonding compound, complying with ASTM C 881, Types I, II, IV and V, Grade 2 (horizontal areas) or Grade 3 (overhead/vertical areas), and Class B (40-60 degrees Fahrenheit) or Class C (60 degree Fahrenheit and above).

1. SurePoxy HM Series by Kaufman Products, Inc., 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.

2. Sikadur Hi-Mod 32 by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071, (800) 933-7452.

3. Epogrip by Sonneborn/-BASF Building Systems, 889 Valley Park Drive, Shakopee, MN 55379, (800) 433-9517.

P. Waterstop: Extruded from virgin polyvinyl chloride plastic compound containing no scrap or reclaimed material or pigment.

1. Size: Minimum 6 inches wide by 3/8 inch thick, unless otherwise indicated.

2. Minimum Tensile Strength (ASTM D 412): 2000 psi.

3. Minimum Ultimate Elongation (ASTM D 412): 350 percent.

4. Shore A/10 Durometer Hardness (ASTM D 2240): Minimum 65; Maximum 83.

5. Maximum 24 Hour Water Absorption (ASTM D 570): 0.15.

Q. Expansion Joint Dowels: Smooth steel expansion joint dowel with minimum 5 inch long steel dowel cap, unless otherwise indicated.

2.2 PROPORTIONING OF MIXES

A. Cast-in-place concrete shall be air-entrained normal weight concrete.

1. Normal weight concrete, except as otherwise specified, shall have a minimum compressive strength of 4000 psi. Slump: Maximum 4 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) at the Site.

2. Normal weight concrete for garage floors, and for exterior slabs, ramps and stairs shall have a minimum compressive strength of 4000 psi, with a minimum of 611 pounds of cement per cubic yard. Slump: Maximum 3 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) at the Site.

3. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight and lightweight concrete up to a maximum of 15 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.

   a. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.

   b. Lower early strength of the concrete shall be considered in deciding when to remove formwork.

B. Slump for Pumped Concrete: When a water-reducing admixture is not used, maximum slump shall be 4 inches. When a water-reducing admixture is used, maximum slump shall be 6 inches and when a high-range water-reducing admixture (superplasticizers) is used, maximum slump shall be 8 inches.

C. Design Air Content: Design air content for concrete shall be 8 percent by volume, with an allowable tolerance of plus or minus 1.5 percent for total air content, except as otherwise specified. Use air-entraining admixture, not air-entrained cement.

D. Water-Cement Ratio: Cast-in-place concrete shall have a maximum water-cement ratio of 0.45.

E. ACI 301, Section 4.2.2.3: Change article to read as follows:

1. 4.2.2.3 - Size of Coarse Aggregates:

   a. 4.2.2.3.a Normal Weight Concrete: Coarse aggregates shall conform to graduation requirements for various sizes as tabulated in Table No. 2 of ASTM C 33. The sizes of coarse aggregates for various classes of Work shall be as follows with all percentages being determined by weight.

   b. 4.2.2.3.b For concrete floors, floor and roof slabs, reinforced beams and girders, columns and piles, concrete encasing underground electric conduits, and concrete in which the space between restricting objects is 2 inches or less, the course aggregate shall be Size No. 67.

   c. 4.2.2.3.c For other concrete Work having a minimum cross-sectional dimension of not more than 6 inches, the coarse aggregate shall be a well graded mixture of No. 67 and No. 57, provided that not more than 50 percent nor less than 30 percent shall be Size No. 67 and not more than 70 percent nor less than 50 percent shall be Size No. 57.

d. 4.2.2.3.d For other concrete Work having a minimum cross-sectional dimension greater than 6 inches and not more than 12 inches, the coarse aggregate shall consist of a mixture of No. 67, No. 57 and No. 467, providing that not more than 25 percent nor less than 10 percent shall be Size No. 67 and not more than 40 percent shall be Size No. 467.

e. 4.2.2.3.e For other concrete Work having a minimum cross-sectional dimension of more than 12 inches, the coarse aggregate shall consist of a mixture of No. 67, No. 57 and No. 357, providing not more than 25 percent nor less than 10 percent shall be Size No. 67 and not more than 40 percent shall be Size No. 357.

F. Application Rate for Corrosion-Inhibiting Admixture: The application rate for the corrosion-inhibiting admixture shall be four (4) gallons per cubic yard of concrete for all concrete placements where indicated on the drawings.

G. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Director.

H. ACI 301, Section 4.1.2.1 - Mixture Proportions:

1. Add the following to paragraph 4.1.2.1:

a. Proposed design mix(es) for pumped concrete and the pumping equipment shall have been tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.

2.3 JOINTS

A. ACI 301, Section 5.3.2.6 - Construction joints and other bonded joints:

1. Delete the following subparagraphs:

a. Use an acceptable adhesive applied in accordance with the manufacturer’s recommendations;

b. Use an acceptable surface retarder in accordance with manufacturer’s recommendations;

c. Roughen the surface in an acceptable manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, or damaged concrete at the surface; or

d. Use Portland-cement grout of the same proportions as the mortar in the concrete in an acceptable manner.

2. Add the following in place of the above subparagraph:

a. The use of bonding agent (adhesive).

b. The use of cement grout.

B. Except as otherwise shown on the Drawings, expansion joints shall be as follows:

1. In joints required to receive a sealant, the joint filler shall be 1/2-inch-thick and recessed as required to form a caulking slot.

2. In joints not required to receive a sealant, the joint filler shall be 1/2-inch-thick and extend through the full cross-section of the concrete.

3. Tool edges of concrete with 1/8-inch radius edging tool.

2.4 PRODUCTION OF CONCRETE

A. Provide ready-mixed concrete, either central-mixed or truck-mixed, unless otherwise approved in writing by the Director.

B. Provide adequate controls to ensure that the temperature of the concrete when placed does not exceed 90 degrees F., and make every effort to place it at a lower temperature. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set or cold joints. Ingredients may be cooled before mixing by shading the aggregates, fog spraying the coarse aggregate, chilling the mixing water or other approved means. Mixing water may be chilled with flake ice or well-crushed ice of a size that will melt completely during mixing, providing the water equivalent of the ice is calculated into the total amount of mixing water.

C. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Do not use items of aluminum for mixing, chuting, conveying, forming or finishing concrete, except magnesium alloy tools may be used for finishing.

B. Check items of aluminum required to be embedded in the concrete and ensure that they are coated, painted or otherwise isolated in an approved manner.

C. Install waterstops in accordance with manufacturer’s printed instructions.

D. Hardened concrete, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.

E. Do not deposit concrete in water. Keep excavations free of water by pumping or by other approved methods.

F. Prior to placement of concrete, remove all hardened concrete spillage and foreign materials from the space to be occupied by the concrete.

G. Prior to placement of a concrete slab-on-grade, ensure roof is watertight and install polyethylene or other preventative measures to mitigate exposure to external moisture sources such as rainwater; runoff from adjacent slopes; landscaping water; water from curing; or wet grinding, sawing, and cleaning.

H. Place vapor barrier directly under concrete slab-on-grade with no cushion or blotter layer.

3.2 ADMIXTURE ADDITIONS AT THE SITE

A. Site additions shall be limited to high-range water-reducers, non-chloride accelerators, and corrosion inhibitors. Comply with manufacturers' printed instructions for discharge of admixtures shall be furnished.

B. High-Range Water-Reducers:

1. Concrete shall arrive at a slump of 2 to 4 inches (50 to 100 mm). Water additions at the Site shall be limited to comply with water-to-cementitious ratio requirements.

2. Following addition of high-range water-reduced concrete, a minimum of 70 revolutions or 5 minutes of mixing shall be completed to assure a consistent mixture.

C. All concrete with other admixture additions shall mix a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

3.3 PLACING

A. Conveying equipment:

1. When pumping concrete, the lubricating mortar for the delivery line shall not be discharged into an area of concrete placement.

2. The inside diameter of the delivery lines for pumped concrete shall be the greater of either a minimum of 5 inches or 3 times the maximum size of coarse aggregate.

B. Operation of truck mixers and agitators and discharge limitations shall conform to the requirements of ASTM C 94.

C. Do not allow concrete to free fall more than 4 feet.

3.4 REPAIRING SURFACE DEFECTS

A. Finish patched areas to match the texture of the surrounding surface.

B. The patch mixture shall consist of a mixture of dry-pack mortar, consisting of one-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for placing and handling. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

3.5 FINISHING FORMED SURFACES

A. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:

1. Rough Form Finish for concrete surfaces not exposed to view.

2. Smooth Form Finish for concrete surfaces exposed to view.

B. Fins shall be completely removed on surfaces to receive waterproofing.

3.6 SLABS

A. Slabs on Grade: Provide key type joints unless otherwise shown. Tool exposed joints.

B. ACI 301, Section 5.3.4 – Finishing unformed surfaces:

1. Add the following paragraph to section 5.3.4.1 Placement:

a. Provide monolithic finishes on concrete floors and slabs without the addition of mortar or other filler material. Finish surfaces in true planes, true to line, with particular care taken during screeding to maintain an excess of concrete in front of the screed so as to prevent low spots. Screed and darby concrete to true planes while plastic and before free water rises to the surface. Do not perform finishing operations during the time free water (bleeding) is on the surface.

C. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:

1. Floated Finish for:

    a. Treads and platforms of exterior steps and stairs.

    b. Slabs and fill over which waterproofing, roofing, vapor barrier, insulation, terrazzo, or resin bound flooring is required.

2. Troweled Finish for:

    a. Interior slabs that are to be exposed to view.

    b. Slabs and fill over which resilient wood flooring, resilient tile or sheet flooring, carpet, or thin-film coating system is required.

    c. Slabs and fill over which thin-set ceramic tile is required, except fine-broom finished surface.

    d. Treads and platforms of interior steps and stairs.

3. Broom or Belt Finish for:

    a. Exterior slabs. Texture as approved by the Director's Representative.

4. Scratched Finish for:

    a. Surfaces to be covered with ceramic tile set in a bonded thick mortar bed, except screed to a Class B tolerance.

    b. Surfaces to be covered with floor topping.

D. Early-entry dry-cut saws are preferred in place of conventional wet-cut saws.

E. Begin saw-cutting as soon as the saw will not dislodge the aggregate or ravel the edge of the saw-cut, but in no case longer than 12 hours after the slab is placed. Saw-cut a minimum of one quarter of the slab depth leaving a clean, sharp edge in the pattern shown on the Contract Documents. Provide sufficient personnel and equipment to complete saw-cutting operations within 18 hours after the slab is placed.

F. Floor flatness and levelness tolerances: For flatness and levelness tolerances of floor slabs refer to ACI 302 Chapter 8.15. Floor surface tolerances shall be 1/8 inch over a horizontal distance of 10 feet in any direction, unless otherwise specified by floor profile quality classifications in ACI 302.

1. When flatness or levelness tolerances are not met then the floor shall be ground or scarified and repoured to meet specifications.

3.7 CURING AND PROTECTION

A. Hot Weather Concreting: Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.

B. Curing Temperature: Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.

C. Curing and Moisture Mitigation for Resilient Flooring:

1 Acceptable curing and drying conditions include a minimum ambient temperature of 70 degrees F and a maximum relative humidity of 50%.

a. Air movement at 15 mph.

2. Do not cure slabs by adding water; ponding or wet burlap method.

3. Do not use curing compounds or cure-and-seal materials unless such use is approved in writing by the adhesive and floor covering manufacturers. The curing product manufacturer's conformance to ASTM c 1315 is not a substitute for the adhesive and floor covering manufacturer's approval.

4. Cure the slab by covering with waterproof paper, plastic sheets, or a combination of the two for 3 to 7 days.

3.8 CHEMICAL HARDENER (DUSTPROOFING)

A. Apply chemical hardener to all troweled finished interior floors which are to be left exposed.

B. Do not apply chemical hardener until concrete has cured the number of days recommended in manufacturer's instructions.

C. Prepare surfaces and apply chemical hardener in accordance with manufacturer's printed instructions and recommendations.

3.9 FIELD QUALITY CONTROL

A. Concrete construction is subject to special inspections as required by the 2015 New York State Building Code and listed in the Statement of Special Inspections.

B. Strength Tests for Pumped Concrete: Prepare strength test specimens and make strength tests from concrete samples obtained at the truck discharge chute and at the end of the pump delivery line in accordance with paragraph 16.3.4.4.

C. Make available to the Owner's Representatives whatever test samples are required to make tests. Furnish shipping boxes for compression test cylinders.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the State and as accepted by the Director. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Director's Representative before using in the work.

E. Test results will be reported in writing to the Director's Representative, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

F. Nondestructive Testing: Impact hammer, Windsor probe, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

G. Additional Tests: The State shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Director's Representative. The testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Pay for such tests when unacceptable concrete is verified, including all inspection and Engineering fees when non-conforming work is verified.

H. Moisture Testing: Test all slabs-on-grade for moisture content that will receive resilient flooring. For a preferred moisture testing method and limits; consult the written instructions of the floor covering manufacturer, the adhesive manufacturer, the patching/underlayment manufacturer, or combination thereof. Test repeatedly until the desired moisture content is obtained.

I. pH Testing: Test concrete floors for pH level prior to the installation of resilient flooring. Do not exceed the recommended pH level of the resilient flooring manufacturer or the adhesive manufacturer, or both.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 03 34 00

CONTROLLED LOW STRENGTH MATERIAL

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 31 00 00.

B. Cast-In-Place Concrete: Section 03 30 00.

1.2 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of Specifications for Structural Concrete for Buildings ACI 301-16 of the American Concrete Institute.

1.3 DEFINITIONS (AMENDMENTS TO ACI 301, CHAPTER 1):

A. Controlled Low Strength Material (CLSM) Fill can also be called by different names including but not limited to: K-Crete, Flowable Fill, Controlled Density Fill, Flowable Fly Ash and Fly Ash Slurry.

1.4 SUBMITTALS

A. Submittals Package: Submit product data for design mix and materials for CLSM specified below at the same time as a package.

B. Product Data:

1. CLSM design mix with name and location of batching plant.

2. Portland Cement: Brand and manufacturer's name.

3. Fly Ash: Name and location of source, and DOT test numbers.

4. Air-entraining Admixture: Brand and manufacturer's name.

5. Water-reducing Admixture: Brand and manufacturer's name.

C. Quality Control Submittals:

1. Certificates: Affidavit required under Quality Assurance Article.

1.5 QUALITY ASSURANCE

A. Furnish and place a Controlled Low Strength Material (CLSM) as shown on plans

or a directed by the engineer, in writing. Provide CLSM containing cement and water. At the Contractor's option, it may contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product will meet the strength and flow consistency requirements included in this specification.

B. CLSM batching plant shall be currently approved as a concrete supplier by the New York State Department of Transportation and shall have a minimum of 1-year experience in the production of similar products.

C. Fly ash supplier shall be currently approved as a fly ash supplier by the New York State Department of Transportation.

D. Source Quality Control: The Director reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:

1. Batching and mixing facilities and equipment.

2. Sources of materials.

1.6 STORAGE

A. Store materials so as to insure the preservation of their quality and fitness for the Work. Materials, even though accepted prior to storage, are subject to inspection and shall meet the requirements of the Contract before their use in the Work.

PART 2 - PRODUCTS

2.1 MATERIALS (AMENDMENTS TO ACI 301, CHAPTER 2):

A. Cement: ASTM C 150, Type I or II Portland cement.

B. Water: Potable.

C. ACI 301, Section 4,2,1,2 - Aggregates:

1. Add the following paragraph:

The aggregate for CLSM shall meet the requirement of ASTM C 33, except 100% passing the ¾" sieve and a maximum of 20% passing the No. 200 sieve.

D. Fly Ash: ASTM C 618, including Table 1A (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.

E. Chemical Admixtures:

1. Darafill by W. R. Grace and Co., 62 Whittemore Avenue, Cambridge, MA 02140, (617) 876-1400, www.graceconstruction.com.

2. Eucon Easy Fill by the Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110, (800) 321-7628, www.euclidchemical.com.

3. MasterCell 25 by Master Builders Technologies, 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5554, (800) 628-9990, www.masterbuilders.com.

4. Sika Lightcrete Powder, Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071, (201) 933-8800, www.sikaconstruction.com.

2.2 CLSM MIXTURE

A. CLSM, Hand Tool Excavatable: Provide mix with compressive strength of 100 psi or less when measured 28 days from placement. Minimum air content at time of placement shall be 20%.

B. In the absence of one year strength data, the cementitious content shall be a minimum of 150 lbs./cy, the minimum air content shall be 20%, and fresh unit weight shall be a maximum of 115 lbs./ft^3, except where specified.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine conditions of substrates and other conditions under which work is to be performed and notify the Engineer, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

B. Keep excavations free of water. Do not deposit CLSM in water.

C. Hardened CLSM, forms, and earth which will be in contact with fresh CLSM shall be free from frost at the time of CLSM placement.

D. Prior to placement of CLSM, remove all foreign materials from the space to be occupied by the CLSM.

3.2 APPLICATION OF CLSM

A. Secure tanks to prevent displacement during placement.

3.3 PROTECTION

A. Protect CLSM from traffic until sufficient strength has been achieved for further construction operations.

3.4 FINISHING

A. Provide a floated finish to the exposed portion of the CLSM.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Controlled Low Strength Material (CSLM) shall be measured by the number of cubic yards of Controlled Low Strength Material (CSLM) placed in accordance with the Contract Drawings as specified under this Section and required to complete the work.

B. A deduction shall be made for pipes (based on nominal diameters) and other payment items when the combined cross-sectional area exceeds 1.0 square foot unless otherwise shown. No deduction will be made for the cross-sectional area of an existing facility.

C. No additional quantity shall be measured for payment to make up losses due to foundation settlement, compaction, erosion or any other cause.

ITEM #	DESCRIPTION	UNIT
X	Controlled Low Strength Material (CSLM)	C.Y.

4.2 PAYMENT

A. Payment for CLSM will be at the contract unit price per cubic yard which shall include all costs of furnishing and placing materials and labor and equipment required to complete the work as specified herein and shown on the contract drawings.

+ + END OF SECTION + +

SECTION 03 60 00

GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. ASTM C33 – Standard Specification for Concrete Aggregate.

2. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).

3. ASTM C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing, and Polymer Concretes.

4. ASTM C939 - Test Method for Flow of Grout for Preplaced- Aggregate Concrete (Flow Cone Method).

5. ASTM C1107 -Packaged Dry, Hydraulic Cement Grout (Non-Shrink).

6. CRD-C 621 -Corps of Engineers Specification for Non-Shrink Grout.

1.3 QUALITY ASSURANCE

A. The Testing Agency:

1. Testing of materials and of resulting grout for compliance with the technical requirements of the specification will be performed by QA/QC consultant employed and paid by the County.

a. The Contractor shall be charged by the County for the cost of any

additional tests and investigation on work performed which does not meet the specifications.

1.4 SUBMITTALS

A. The Contractor shall submit Shop Drawings and material specifications for the approval of the Engineer. Shop drawings shall include, but not be limited to:

1. Material certifications and technical data sheets.

2. Samples of all materials to be used.

3. Proposed mix proportions for cement grout.

B. The Contractor shall also submit the following:

1. Certified test results verifying the compressive strength, shrinkage and expansion requirements specified herein.

2. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.

PART 2- PRODUCTS

2.1 MATERIALS

A. Cement Grout

1. Cement grout shall be composed of Portland cement, sand and water. The sand to be used shall be selected to suit the spacing for placement. Where sand is not usable, the grout shall be composed of cement and water only.

2. Gradation of sand for cement grout shall be in accordance with ASTM C33. Cement grout shall be proportioned such that it achieves a 28-day compressive strength of 4,000 psi. The Contractor shall be responsible for developing the mix proportions.

a. Gradation for Natural Sand:

Sieve Size	Spaces less than one (1) inch	Spaces one (1) inch or more
Passing 3/8”		100
Passing # 4	100	95-100
Passing # 8	95-100	80-100
Sieve Size	Spaces less than one (1) inch	Spaces one (1) inch or more
Passing # 16	70-100	50-85
Passing # 30	40-75	25-60
Passing # 50	10-35	10-30
Passing # 100	2-15	2-10
Passing # 200	--	--

3. Water shall be kept to a minimum, the amounts noted in the preceding table are the maximum for grout. Proportioning by volume shall be limited to small quantities mixed at the job site.

4. White Portland cement shall be mixed with the Portland cement as required to match the color of adjacent concrete.

B. Non-Shrink Grout

1. The grout material shall be an approved ready to use mixture requiring only water for use at the job site. The compressive strength of 2-inch cubes shall be 3,000 psi at 7 days.

2. Non-shrink grout shall conform to CRD-C 621 and ASTM C1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per ASTM C939 at temperature extremes of 45 degrees Fahrenheit and 90 degrees Fahrenheit and an extended working time of 15 minutes.

3. Non-shrink grout product and manufacturer shall be as specified in this Section.

4. Non-shrink grouts depending on oxidation to limit shrinkage and containing additives such as iron or steel particles shall not be used.

C. Epoxy Grout

1. Epoxy grout shall be modified as required for each particular application with aggregate per manufacturer's instructions.

2. Epoxy grout product and manufacturer shall be as specified in this Section.

D. Dry Pack

1. Dry pack (to be packed or tamped in place) shall be made at no slump consistency.

2. When mixing the batch, only enough water shall be added to the dry materials to produce a rather stiff mixture, then additions of water may be made in small increments until the desired consistency is obtained.

E. Curing Materials

1. Curing materials for cement grout shall be as specified in Section 03 30 00 - Cast-in-Place Concrete and as recommended by the manufacturer for prepackaged grouts.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Installation

1. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency shall be such that the grout is plastic and moldable but will not flow.

2. Measurements for cement grout shall be made accurately by weight or by volume using containers. All measurements shall be made in a manner satisfactory to the Engineer. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted, be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped.

4. For grouting beneath base plates, grout shall be poured from one side only and shall flow across to the open side to avoid air-entrapment.

5. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer.

3.2 FIELD TESTING / QUALITY CONTROL

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications.

2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

3. Compression tests and fabrication of specimens for epoxy grout shall be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.

B. All grout which has already been placed and which fails to meet the requirements of this Section is subject to removal and replacement by the Contractor at no additional cost to the City

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 04 05 13

MORTAR

PART 1 - GENERAL

1.1 REFERENCES

A. Standards:

1. Mortar: ASTM C 270, except as otherwise specified.

2. Grout: ASTM C 476.

1.2 SUBMITTALS

A. Product Data:

1. Portland Cement: Brand and manufacturer's name.

2. Masonry Cement: Brand and manufacturer's name.

3. Lime: Brand and manufacturer's name.

4. Sand(s): Location of pit, name of owner, and previous test data.

5. Color Pigments: Brand and manufacturer's name.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials in a manner which will insure the preservation of their quality and fitness for the Work.

B. Store cement and lime on raised platforms under waterproof, well ventilated cover.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00, Submittals

B. Section 01 74 00, Construction Waste Management

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: One of the following complying with the indicated requirements:

1. Portland Cement: ASTM C 150, Type 1, of natural color or white as required to produce the desired color.

a. Fly Ash: Comply with ASTM C593.

1) Recycled Content: Minimum 15 percent pre-consumer recycled content at contractor's option.

a) Type 1: 81 g, 15 percent.

2. Masonry Cement: ASTM C 91, of natural color or custom color as required to produce the desired color.

a. Fly Ash: Comply with ASTM C593.

1) Recycled Content: Minimum 5 percent post-consumer recycled content, or minimum 20 percent pre-consumer recycled content at contractor's option.

a) Type M: 27 g, 5 percent; 108 g 20 percent.

b) Type S: 26 g, 5 percent; 102 g, 20 percent.

c) Type N: 24 g, 5 percent; 96 g 20 percent.

B. Hydrated Lime: ASTM C 207, Type S.

C. Mortar Sand: ASTM C 144, except that for joints less than 1/4 inch thick use sand graded with 100 percent passing the No. 16 sieve.

1. Sand for White Mortar: Natural white sand or ground white stone.

2. Sand for Colored Mortar: Ground marble, granite, or other sound stone, as required to match approved sample.

D. Grout Sand: ASTM C 404.

E. Color Pigments: High purity, finely ground, chemically inert, unfading, lime proof mineral oxides specially prepared for use in mortar.

F. Water: Clean and free of deleterious amounts of acids, alkalis, and organic materials.

2.2 MIXES

A. Mortar for Unit Masonry: Comply with ASTM C 270, proportion specifications, except limit materials to those specified.

1. Colored Mortar: Proportion color pigments with other ingredients as necessary to match required color, except limit pigments other than carbon black to a maximum of 10 percent of cement content by weight and limit carbon black to a maximum of 3 percent of cement content by weight.

B. Grout: Comply with ASTM C 476. If grout types are not indicated on Drawings, furnish type (fine or coarse) most suitable for the particular job conditions to completely fill cavities and embed reinforcement and other built-in items.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to sections of Specifications which require mortar and masonry grout.

3.2 MORTAR SCHEDULE

A. Where mortar types are not indicated on Drawings or specified, use types as follows:

1. Type M for unit masonry below grade in contact with fill materials.

2. Type S for concrete masonry units.

3. Type N for brick masonry units.

a. Proportion Portland cement, lime, and sand in a 1:1:6 ratio.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 04 15 00

MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide masonry accessories as shown and specified.

2. The types of masonry accessories required include the following:

a. Continuous horizontal wire reinforcing and ties.

b. Individual metal ties.

c. Anchoring devices.

d. Concrete inserts.

e. Miscellaneous accessories.

3. This Section specifies the masonry accessories for Work under the following Sections:

a. Section 04 20 10, Unit Masonry Construction.

B. Related Work Specified Elsewhere:

1. Section 04 05 13, Mortar.

2. Section 04 20 10, Concrete Masonry Units.

3. Section 04 21 00, Brick Masonry.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire resistance classification is shown or scheduled for unit masonry construction (4-hour, 3-hour and similar designations), provide accessories complying with the requirements established by UL and the New York State Uniform Fire Prevention and Building Code.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. ASTM A 82, Cold Drawn Steel wire for Concrete Reinforcement.

2. ASTM A 153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

3. ASTM A 240, Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and General Applications.

4. ASTM A 615, Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.

5. ASTM A 1064, Carbon-Steel Wire and Welded Wire Reinforcement, Plain or Deformed, for Concrete.

6. ASTM B 227, Hard-Drawn Copper-Clad Steel Wire.

7. ASTM D 1752, Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

8. UL, Design Number U907.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit for approval to Engineer copies of manufacturer's specifications and installation instructions for each masonry accessory required. Include data substantiating that materials comply with specified requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver accessories in original packages, plainly marked with identification of materials and manufacturer.

B. Storage of Materials: Store and cover materials to prevent corrosion and deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Continuous Wire Reinforcing and Ties for Masonry: Welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner "L" and intersection "T" units. Fabricate from cold drawn steel wire complying with ASTM A 1064, with deformed continuous 9 gage side rods and plain 9 gage cross

rods, crimped for cavity wall construction, with unit width of 1-1/2 to 2 inches less than thickness of wall or partition. All reinforcing shall be hot dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A 153, Class B-2 unless otherwise specified.

1. For single-wythe masonry, use units fabricated as follows:

   a. Truss type fabricated with single pair of side rods and continuous diagonal cross-rods spaced not more than 16 inches on centers.

   b. Product and Manufacturer: Provide one of the following:

      1) 120 Truss-Mesh by Hohmann and Barnard Company.

      2) Or approved equal.

2. For multi-wythe masonry, use units fabricated as follows:

   a. Tab type fabricated with single pair of side rods in interior wythe and adjustable two piece rectangular box type crossties spaced not more than 16 inches on centers. Space side rods for embedment in each face of back-up wythe and extend ties for proper embedment in facing wythe.

   b. Product and Manufacturer: Provide one of the following:

      1) 165-2X Adjustable Truss by Hohmann and Barnard Company.

      2) Or approved equal.

B. Individual Wire Ties for Masonry: Fabricate from 3/16-inch cold drawn steel wire complying with ASTM A 1064, with 1.5 ounces per square foot of hot-dip coating complying with ASTM A 153, Class B-2 of the length required for proper embedment in wythes of masonry shown.

1. For use with hollow masonry units laid with cells vertical, provide rectangular shaped ties.

2. For use with solid masonry units or hollow units laid with cells horizontal, provide ties with ends bent to 90 degree angles to form hooks not less than 2 inches long.

3. Product and Manufacturer: Provide one of the following:

   a. Byna-Lok Seismic Wire Tie by Hohmann and Barnard Company.

b. Or approved equal.

4. Where facing and backup joints do not align, use adjustable two piece ties with compression/tension bar.

a. Product and Manufacturer: Provide one of the following:

1) Adjustable Wall Ties (Pinlets and Eyes with 2X-Hook) by Hohmann and Barnard Company.

2) Or approved equal.

C. Anchoring Devices for Masonry: Use straps, bars, bolts, and rods of the type and size shown and as follows:

1. Flexible Anchors: Where masonry is shown or specified to be anchored to structural framework with flexible anchors, use anchors which will permit horizontal and vertical movement of masonry but will provide lateral restraint, and as follows:

a. For anchorage to concrete framework, use two piece anchors with 22 gage sheet metal dovetail with 1.5 ounces per square foot of hot dip zinc coating complying with ASTM A 153, Class B-2, or stainless steel, ASTM A 240, and 16 gage rectangular corrugated tie 1-inch wide sized to extend to within one inch of face of masonry or to a depth of 12 inches.

1) Product and Manufacturer: Provide one of the following:

a) BL-303 Corrugated Dovetail Brick Tie by Blok-Lok, a Division of Hohmann and Barnard Company.

b) Or approved equal.

b. Provide concrete inserts and other items shown, specified or required by others. Refer to Section 04201, Unit Masonry Construction, paragraph 1.1.B for requirements of coordination by others.

c. For anchorage to existing concrete and masonry use 16 gauge rectangular corrugated tie 1-1/4 inches wide sized to extend to within one inch of face or masonry.

1) Product and Manufacturer: Provide one of the following:

a) 345-SV by Hohmann and Barnard Company.

b) Or approved equal.

2) Lateral Supporting Masonry Wall Anchors: Provide 3/8-inch thick by 2-inches wide of length to extend to center of each wythe. Fabricate from steel with 1.5 ounces per square foot of zinc coating complying with ASTM A 153, Class B-2.

D. Miscellaneous Masonry Accessories:

1. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 of the sizes shown.

2. Compressible Filler:

a. Use foamed polyurethane strip saturated with polybutylene waterproofing material. When compressed to 50 percent of its original volume, filler shall provide a watertight joint. The manufacturer shall furnish a certificate of compliance with these requirements. Filler shall maintain its resiliency to allow for installation in temperatures as low as -14°F, but not above 95°F. Filler shall be waterproof when compressed to 50 percent of its original volume in temperatures from -40 F to +200 F. Elongation shall be at least 250 percent with a tensile strength of not less than 100 psi. No migration of polybutylene compound in the polyurethane strip will be allowed.

b. Product and Manufacturer: Provide one of the following:

1) NS-Closed Cell Neoprene Sponge by Hohmann and Bernard Company.

2) Or approved equal.

3. Premolded Control Joint Strips for Concrete Masonry Units: Solid rubber strips with a Shore A durometer hardness of 60 to 80, designed to fit standard sash block and maintain lateral stability in masonry wall, size and configuration shall be as shown.

a. Cavity Fill Mesh: Provide 1/2-inch mesh hardware cloth, backed with asphalt impregnated cloth below. Install below all block courses that are to be filled with mortar.

b. Neoprene Control Joint Strips for Brick Masonry: Provide bellows type strip made from 1/16-inch cured, calendered neoprene with perforated flanges.

1) Product and Manufacturer: Provide one of the following:

a) Vertical wall expansion joints by Johns Manville.

b) RS Series-Rubber Control Joint by Hohmann and Barnard Company.

c) Or approved equal.

c. Weep Holes: Provide 1/4-inch outside diameter by 4-inches long clear plastic tubes as applicable or otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 042000, Concrete Masonry Units.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 04 20 10

UNIT MASONRY CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide unit masonry construction as shown and specified. The Work also includes:

a. Providing openings in masonry to accommodate the Work under this and other Sections and building into the masonry all items such as sleeves, anchor bolts, inserts and all other items to be embedded in masonry for which placement is not specifically provided under other Sections. Provide lintels in all openings or where directed by the Engineer.

b. Providing openings in masonry to accommodate the work under other contracts and assisting other contractors in building into the masonry all items such as sleeves, anchor bolts, inserts and all other items required to be embedded in masonry under other contracts.

c. Cutting and removing existing masonry for new openings and new abutting walls.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the masonry.

2. Notify other contractors in advance of the construction of the masonry to provide the other contractors with sufficient time for the installation of items included in their contracts that must be installed with the masonry.

3. This Section specifies the installation of unit masonry specified in the following:

a. Section 04 21 00, Brick Masonry.

b. Section 04 22 00, Concrete Masonry Units.

C. Related Work Specified Elsewhere:

1. Section 033000, Cast-in-Place Concrete.

2. Section 041513, Mortar.

3. Section 041500, Masonry Accessories.

4. Section 042100, Brick Masonry.

5. Section 055000, Metal Fabrications.

6. Section 076000, Flashing and Sheet Metal.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire resistance classification is shown or scheduled for unit masonry construction (4-hour, 3-hour, and similar designations), comply with applicable requirements for materials and installation established by UL and other governing authorities.

B. Codes and Reference Standards: Comply with the applicable requirements of the New York State Uniform Fire Prevention and Building Code for the types of masonry construction shown and the following standards: ANSI A41.1 R70 Code Requirements for Masonry. ACI 531.1 Specifications for Concrete Masonry Construction Brick Industry Association, "Technical Notes on Brick and Tile Construction". Brick Industry Association Technical Bulletin 1, "Cold Weather and Hot Weather Construction." Brick Industry Association, Technical Notes on "Cleaning Brickwork". National Concrete Masonry Association, "Guide Specifications" and "Technical Bulletins". UL, Design Numbers U901 through U907.

C. Construction Tolerances: In accordance with ACI 531.1 and the following:

1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 1/4 inch in 10 feet, or 3/8 inch in a story height or 20 feet maximum, nor 1/2 inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4 inch in any story or 20 feet maximum, nor 1/2 inch in 40 feet or more.

2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.

3. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/4 inch.

D. Presubmittal Meeting: Before erecting the job mock-up, the Contractor and his installer shall meet on-site with the Engineer to discuss approved products and workmanship to ensure a match to existing adjacent masonry.

E. Job Mock-up:

1. Prior to installation of unit masonry work, but after Engineer's approval of samples, erect job mock-up using materials, pattern bond and joint tooling shown or specified for final Work, to match existing adjacent masonry construction. Provide special features as directed including finished opening 1 foot-4 inches by 1 foot-4 inches, finished end, and expansion joint. Build mock-up at the site in location approved by the Engineer. The mockup shall be of full thickness and approximately 6 feet long by 4 feet high unless otherwise shown. Indicate the proposed range of color, texture and Workmanship to be expected in the completed work. Obtain Engineer's acceptance of visual qualities of the mock-up before start of masonry Work. Retain and protect mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until given written permission by Engineer. Masonry construction that does not meet the standards approved on the sample panel shall be removed and rebuilt as required by Engineer. Provide mock-up panel for typical exterior and interior sections to match existing adjacent areas.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver all materials to the site in the manufacturer's original unbroken, undamaged and unopened packaging with labels bearing the name of the manufacturer and the product. Masonry units and brick shall be factory packaged and strapped, delivered to the site and stored on skids.

B. Storage of Materials:

1. Protect masonry materials during storage and construction with a properly erected shelter from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.

2. Store and handle all materials to prevent inclusion of water or foreign matter and to prevent damage of any nature. Packaged units kept in original unopened packages until time for use.

3. Distribute materials on floor slabs to prevent overloading. Designated live loads shown for floor shall not be exceeded.

C. Handling Materials:

1. Handle materials in a manner that minimizes chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished work.

1.4 JOB CONDITIONS

A. Environmental Requirements: Do not place any masonry when air temperature is 40°F and falling. Masonry may be placed when air temperature is 32°F and rising. In either case, it may not be placed if temperature is expected to drop below 32°F during next 72 hours unless adequate protection is provided as specified in 1.4.B.4.b. below.

B. Protection:

1. Protect partially completed masonry against weather, when Work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2 feet down both sides of walls and hold securely in place.

2. Do not apply uniform floor or roof loading for at least three days after completing masonry columns or walls.

3. Do not apply concentrated loads for at least seven days after completing masonry columns or walls.

4. Cold Weather Protection.

a. When surrounding air temperature is 48°F to 40°F protect masonry construction from rain or snow for a minimum of 48 hours by covering with nonstaining weathertight membrane.

b. When surrounding air temperature is 40°F and below maintain masonry construction temperature above 40°F for a minimum of 48 hours by enclosure and supplementary heat, electric heating blankets, infrared lamps, or other methods acceptable as directed by the Engineer.

5. Hot Weather Protection: Protect masonry construction, by methods acceptable to Engineer, from direct exposure to wind and sun when the surrounding air temperature is 99°F in the shade with relative humidity less than 50 percent.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to the following Sections for required masonry materials:

1. Section 03 30 00, Cast-In-Place Concrete.

2. Section 04 05 13, Mortar.

3. Section 04 15 00, Masonry Accessories.

5. Section 04 20 00, Concrete Masonry Units.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which unit masonry Work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 PREPARATION

A. Clean dirt, debris, oil, grease and other materials which would effect the bond of mortar from all surfaces to receive work under this Section.

B. Wetting of Masonry Units:

1. Brick: Wet brick having ASTM C 67 absorption rates greater than 0.25 ounce per square inch per minute.

a. Determine absorption by placing 20 drops of water inside a circle the size of a quarter on typical units. If water is absorbed within 1-1/2 minutes, wet brick before laying.

2. Use wetting methods which ensure that each masonry unit is nearly saturated but surface dry when laid.

3. Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.

3.3 INSTALLATION, GENERAL

A. Thickness: Build walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Build chases and recesses as applicable and shown or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

C. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of masonry Work. After installation of said items, complete masonry Work to match Work immediately adjacent to openings.

D. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full size units without cutting wherever possible.

E. Matching Adjacent Existing Masonry Work: Match coursing, pattern bond color and texture of new masonry work with adjacent existing work.

3.4 LAYING MASONRY WALLS

A. General:

1. Mortar Types: Unless otherwise indicated, use mortar as specified in Section 04100, Mortar, and as follows:

   a. For all Work, use Type S mortar.

   b. Do not use mortar which has begun to set or if more than 1/2 hour has elapsed since initial mixing. Retemper mortar during the 1/2-hour period only as required to restore workability.

2. Layout walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, expansion joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.

3. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.

4. Pattern Bond: Lay exposed masonry in running bond and as shown to match adjacent existing masonry. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than 4-inch horizontal face dimensions at corners or jambs.

B. Mortar Bedding and Jointing:

1. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush in cross joints and do not furrow bed joints. Use trowel edge for flat bed joints. Fill all parapet blocks solid with grout.

2. Bed and lay brick and concrete masonry units at the proper angle with fully slushed joints.

3. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers columns and pilasters and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.

   a. Maintain 3/8-inch joints, except for minor variations required to maintain half bond.

4. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials. unless otherwise shown.

5. Tool exposed joints slightly concave, to match existing. Rake out mortar in preparation for application of caulking or sealants where required.

6. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not hammer or otherwise force brick at corners, whether at jambs or changing the direction of a wall in order to force plumb the corner or jamb. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Collar Joints:

1. Fill the vertical space between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging, for the following masonry work:

   a. All walls, except cavity walls, and interior walls and partitions.

D. Stopping and Resuming Work: Rack back 1/2-brick length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

E. Built-in Work:

1. As the Work progresses, build in items shown, specified or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Fill cores in one block width solidly with masonry around built-in items.

   a. Fill space between hollow metal frames and masonry solidly with mortar.

   b. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of cavity fill mesh in the joint below and rod mortar or grout into core.

F. Interior Walls:

1. Nonload-Bearing Interior Partitions and Interior Wythe of Cavity Walls: Build full height of story to underside of structure above, unless otherwise shown.

2. Tie walls at top and sides with masonry anchors as specified in Section 04150. Insert compressible filler, specified in Section 04150, in all horizontal and vertical joints where masonry terminates. Insert filler 3/4 inches from both faces of masonry. Use filler four times as thick as the widest part of the joint. Thickness of filler shall be a minimum of 4 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by 3 inches and compress ends to form tight joint. Finish with backer rod and sealant.

3. At masonry walls requiring a fire rating use fire safing insulation specified in Section 07210. Insert insulation in a continuous, vaportight, solid blanket to 3/4-inches from both faces. Finish with backer rod and sealant.

G. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as shown and specified. Refer to Section 04150, Masonry Accessories, for type of reinforcing units required. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge control and expansion joints with reinforcing.

2. Reinforce all walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.

3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

4. Space continuous horizontal reinforcing as follows:

   a. For multi-wythe walls, solid or cavity, where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by code but not more than 16 inches on centers vertically.

   b. For single wythe walls, space reinforcing at 16 inches on centers vertically, unless otherwise shown.

   c. For parapets, space reinforcing at 8 inches on centers vertically, unless otherwise shown.

5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 24 inches beyond jambs of the opening.

   a. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the above.

H. Anchoring Masonry Work:

1. Provide anchoring devices of the type shown and as specified under Section 04150, Masonry Accessories. If not shown or specified, provide standard type for facing and backup involved.

2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

   a. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

   b. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.

   c. Space anchors as shown, but not more than 16 inches on center vertically and 36 inches on center horizontally.

3. Anchor single wythe masonry veneer to backing with metal ties as follows:

   a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.

   b. Anchor veneer to concrete back up with dovetail anchors.

   c. Anchor veneer to existing concrete and masonry backup with corrugated anchors attached with stainless steel expansion bolts.

I. Control Joints:

1. Provide vertical expansion, control and isolation joints in masonry where shown. Build in related items as the masonry Work progresses. Rake out mortar in preparation for application of caulking and sealants. Refer to Section 07920, Caulking and Sealants.

   a. Provide items specified under Section 04150, Masonry Accessories, where shown.

      1) Build flanges of factory fabricated neoprene control joint into brick masonry and premolded control joint strips into concrete unit masonry. Refer to Section 04150.

      2) Build in compressible fillers specified under Section 04150, Masonry Accessories, where shown. Install in accordance with manufacturer's written instructions.

2. Control Joint Spacing: Where location of control joints are not shown, place vertical joints spaced not to exceed 50 feet-0 inches on centers for clay masonry or 35 feet-0 inches on centers for concrete masonry wythes if reinforced. Locate control joints in the masonry Work as shown and including the following:

   a. At structural column or joint between bays.

   b. Above expansion or control joints in the supporting structure.

   c. Above major openings at end of lintels upward and below at ends of sills downward. Place at one side of jamb for openings less than 6 feet-0 inches wide and at both sides for openings over 6 feet-0 inches wide.

   d. At vertical chases, recesses and other points of reduction in wall thickness.

e. At locations where masonry wall height changes by more than 20 percent.

f. Where masonry abuts supporting structure.

g. At a distance equal to 1/2 the wall height from corners or intersections with other masonry.

h. Submit joint locations to Engineer for approval.

J. Lintels:

1. Provide steel lintels and masonry U-block lintels, where shown on the Contract Drawings, and specified in Section 055000, Metal Fabrications.

2. Provide masonry lintels where shown and wherever openings of 16 inches or more are shown without structural lintels. Provide precast or formed in place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

a. Unless otherwise shown, provide one horizontal reinforcing bar for each 4 inches of wall thickness, of size-number not less than the number of feet of opening width.

b. For hollow masonry unit walls, use specially formed "U" shaped lintel units with reinforcing bars placed as shown, filled with Type M mortar.

3. Provide minimum bearing at each jamb, of 4 inches for openings less than 6 feet-0 inches wide, and 8 inches for wider openings.

K. Flashing of Masonry Work:

1. Provide concealed flashings in masonry Work as shown. Refer to Section 076000, Flashing and Sheet Metal, for type of flashing required. Prepare masonry surfaces smooth and free from projections which might puncture flashing. Place through wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2 inch from face of wall, unless otherwise shown.

a. Extend flashings beyond edge of lintels and sills at least 4 inches and turn up edge on sides to form pan to direct moisture to exterior.

b. Install elastic flashings in accordance with manufacturer's instructions.

2. Provide 3/8" wide x 1 1/2" long plastic insert type weep joints in the head joints of the first course of masonry immediately above concealed flashings. Space 24 inches on center, unless otherwise shown.

3. Install reglets and nailers for flashing and other related work where shown to be built into masonry Work.

4. Install emergency scuppers as shown.

3.5 CUTTING AND REMOVING EXISTING MASONRY

A. Wherever existing masonry is shown to be cut and removed use methods that will produce sharp, true edges to accept new abutting work.

3.6 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Cleaning Exposed, Unglazed Masonry Surfaces:

1. Wipe off excess mortar as the Work progresses. Dry brush at the end of each day's work.

2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain Engineer's acceptance of sample cleaning before proceeding to clean remainder of masonry work.

a. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.

b. Presoak wall by saturating with water and flush off loose mortar and dirt.

c. Scrub down wall with stiff fiber brush and a solution of 1/2 cup of trisodium phosphate and 1/2 cup of household detergent dissolved in one gallon of water.

d. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.

e. Acid cleaning of masonry will not be permitted.

3. Clear Coatings: See Section 09900, Painting.

D. Protection:

1. Protect the masonry Work from deterioration, discoloration or damage during subsequent construction operations.

2. When work on any brick or block masonry is finished for the day or discontinued on account of rain or snow, or where top of new work is likely to be damaged by storms, sloping planks covered with tarred felt shall be placed over the top of walls.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The General Contractor shall furnish all labor, materials, equipment and incidentals required to provide concrete unit masonry as shown and specified.

2. The extent of each type of block is shown on the Drawings.

B. Related Work Specified Elsewhere:

1. Section 04 05 13, Mortar.

2. Section 04 15 00, Masonry Accessories.

3. Section 04 20 10, Unit Masonry Construction.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for concrete unit masonry construction (4-hour, 3-hour and similar designations), provide units complying with the requirements established by the UL, governing authorities and the New York State Uniform Fire Prevention and Building Code for types of concrete unit masonry shown.

B. Source Quality Control: Obtain units from one manufacturer, cured by one process and of uniform texture and color, for each type required.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM C 33, Standard Specification for Concrete Aggregates.

2. ASTM C 90, Hollow Load-Bearing Concrete Masonry Units.

3. ASTM C 129, Hollow, Non-Load Bearing Concrete Masonry Units.

4. ASTM C 145, Solid Lightweight Load-Bearing Concrete Masonry Units.

5. ASTM C 331, Standard Specification for Light-weight Aggregates for Concrete Masonry Units.

6. ASTM E 84, Standard Method of Test for Surface Burning Characteristics of Building Materials.

7. ASTM C 140, Sampling and Testing Concrete Masonry Units.

1.3 SUBMITTALS

A. Samples: Submit for approval samples of each type of concrete masonry unit specified. Select units to show range of color and texture which can be expected in the finished Work. Engineer's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

B. Manufacturer's Data: Submit for approval copies of manufacturer's specifications and test data for each type of concrete masonry unit required, including certification that each type complies with the specified requirements. Include instructions for handling, storage, installation and protection of each type of concrete masonry unit.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver concrete masonry units in unopened, undamaged original packages and pallets, plainly marked with identification of materials and manufacturer.

B. Storage of Materials: Store and cover concrete masonry units to prevent damage such as chipping and staining. Store and handle all materials to prevent inclusion of water or foreign matter and to prevent damage of any nature. Packaged units shall be kept in original unopened packages until time for use.

C. Distribute materials on floor slabs to prevent overloading. Designated live loads shown for floor shall not be exceeded.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Size: Manufacturer's standard units with nominal face dimensions of 16 inches long by 8 inches high (15 5/8 inches by 7 5/8 inches actual), unless otherwise specified.

B. Special Shapes: Provide lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions where shown. Provide bullnose block for outside corners where shown or where used in adjacent masonry.

2.2 CONCRETE MASONRY UNITS

A. General: All materials utilized on this job shall be new and the compressive strength of the assembled masonry (f/m) shall be at least 1,500 psi in accordance with ACI 530.

B. Concrete Block (C.M.U.):

1. General: Where concrete masonry units are shown, comply with the following classifications, weights, grades, curing, and other requirements as specified.

2. Hollow Load-Bearing Concrete Masonry Units nominally 6 inches or more in thickness: ASTM C 90, Type I.

3. Hollow Non-Load Bearing Concrete Masonry Units nominally less than 6 inches: ASTM C 129, Type I.

4. Solid Load-Bearing Concrete Masonry Units: ASTM C 90, Type L

5. Concrete Building Brick: ASTM C 55, Type I, Grade N.

6. Fire Rated Units: Aggregate type and equivalent solid thickness as required to obtain the fire resistance rating indicated. Fire resistance ratings shall be based on fire tests in accordance with ASTM E 119.

7. Weight: Provide normal weight units using aggregate complying with ASTM C 90 producing dry net weight of not less than 125 pounds per cubic foot, unless otherwise specified.

   a. Aggregate:

      1) Lightweight Units: ASTM C 331; dry net weight not more than 105 lb per cu ft.

      2) Normal Weight Units: ASTM C 33; dry net weight not less than 125 lb per cu ft.

8. Special Shapes: Units of shape and size required for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions indicated.

   a. Outside Corners: Square edge units.

   b. Units for Walls and Partitions to be Filled with Loose Type Insulation: Two cell (core) units.

9. Curing: Cure units in a moisture controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C 90, Type I.

    a. Limit moisture absorption during delivery and until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the United States Weather Bureau Station nearest the project site.

10. Exposed Faces: Provide manufacturer's standard and custom color and texture, unless otherwise indicated.

11. Units shall be manufactured not less than 30 days prior to being used and stored under cover until shipment.

C. Architectural Concrete Block (C.M.U.):

1. Hollow Load Bearing Units: Provide unit type and size(s) indicated on the drawings

    a. Masonry units meeting all ASTM C 90 testing requirements and containing integral mixed color with product types listed below. Type selection is as specified on the drawings:

        1) Brik structural masonry units [optional: with Water Control Technology (WCT)]

        2) Brik masonry veneer units

        3) Brik Jumbo structural masonry units.

        4) Thermal Hi-R Half High Insulated masonry units (Spec-Brik HI-R when using Spec-Brik blended colors)

        5) Thermal Hi-R-H Half High insulated masonry units (Spec-Brik HI-R-H when using Spec-Brik blended colors)

        6) Thermal Hi-R insulated Masonry Units.

        7) Thermal Hi-R-H insulated Masonry Units.

        8) Surface smooth and dense masonry units for painting.

        9) Split - Splitface masonry units

        10) Polished and Textured specialty masonry units.

    b. Unit Weight:

        1) Normal weight units.

c. Linear shrinkage: Not to exceed 0.065 percent, ASTM C 90.

d. Unit Compressive Strength: Minimum net area compressive strength of 2,000 psi.

e. Integral Water Repellent Concrete Masonry Units: Provide all exterior wall architectural concrete masonry units, including single wythe walls and facing units, containing the manufacturer's recommended type and amount of an integral polymeric water repellent admixture.

f. Color as selected by Owner from manufacturer's standard color selection chart.

2. Special shapes:

a. Provide closures, jamb units, headers, lintels, bond beams and other special shapes as indicated on the drawings.

b. Provide standard manufactured sizes or cut full size units for fractional course height and lengths.

D. Pre-installed, U-shaped Concrete Masonry Insulation: (Where applicable or otherwise indicated on Drawings)

1. Product: Korfil inserts manufactured by Concrete Block Insulating Systems & available exclusively from Concrete Masonry Block Producers.

2. Pre-installed U-shaped, Concrete Masonry Unit Insulation.

a. Description: Inserts pre-installed in CMU's prior to delivery to jobsite shall comply with ASTM C 578; Standard Type X.

b. Physical Properties:

1) Moisture Absorption: ASTM C 272= < 1.0% by volume

2) Fire Characteristics:

a) ASTM E 84 – Flame Spread < 5.

b) ASTM E 119 – Insert shall cause no reduction in hourly rating.

c. Thermal Resistance (R) per inch of thickness = 5.00.

d. Drainage: Allows full drainage of water in cores of masonry units.

e. Rot & Vermin Resistance: Produced from expanded polystyrene –fully resistant to rot; does not attract vermin, termites or rodents.

f. Density: ASTM C 303 – 18.3 kg/m3 (1.3 lb./cu. ft.)

g. Components: Insulation shall contain no fluorocarbons and no formaldehyde.

h. Shape: U-shaped insert accomplishing compression fit with inside spaces of both the front and rear face shells and the central web of the CMU allowing rebar placement at center of wall, and handhold access at center web of the CMU.

E. Pre-installed insulated HI-R Masonry Units for Non-Load Bearing Walls

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1500 psi.

2. Weight Classification: Normal weight.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by Engineer's sample.

5. Split faced CMU: Color shall be selected by the Owner from manufacturer's standard colors.

F. Pre-installed insulated two piece, interlocking, HI-R-H Masonry Units for Load Bearing Walls

1. Concrete Block Insulation Systems, Inc. expanded polystyrene Insulation Inserts made from flame-retardant treated expandable polystyrene by Korfil Hi-R-H insulation, Icon Universal Inserts, or approved equal, which are to be pre-installed in the CMU's prior to delivery to jobsite.

2. Physical Properties of EPS:

a. Typical Density (lbs./cu.ft.) Min.: 1.05-1.50

b. Thermal Resistance (R) per inch: 5.00

c. Water Vapor Permeance: 1.10

d. Water Absorption% volume: <1.00

e. Flame Spread Rating: <5.00

3. Additional Properties of EPS Inserts:

a. Rot and Vermin resistance: Produced from expanded polystyrene – full resistant to rot; does not attract vermin, termites or rodents.

b. Components: Insulation shall contain no fluorocarbons and no formaldehyde.

c. Shape: Two-piece, interlocking insert shall overlap at both head & bed joints with edges of adjacent inserts of the same type. Keyway shall be provided for butt welded cross-rods of 16" o.c. ladder type horizontal wall reinforcement.

2.3 MASONRY CELL INSULATION

A. Molded-Polystyrene Insulation Units: CBIS KORFIL Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.

B. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.4 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers:

a. Diedrich Technologies, Inc.

b. EaCo Chem, Inc.

c. ProSoCo, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 04201, Unit Masonry Construction.

B. For Korfill Concrete Masonry Unit:

1. General: Inserts shall be pre-installed by CMU manufacturer prior to Delivery to jobsite.

2. Unless otherwise indicated on Construction Documents, inserts shall be left in place when grouting.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 05 50 30

ANCHOR BOLTS, EXPANSION ANCHORS AND CONCRETE INSERTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide anchor bolts, expansion and adhesive anchors and concrete inserts, etc. as shown and specified.

B. This Section includes all bolts, anchors and inserts required for the Work but not specified under other Sections.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.

1. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners.

2. ASTM A 320, Alloy-Steel Bolting Materials for Low-Temperature Service.

B. Expansion anchors and inserts shall be UL or FM approved.

1.3 SUBMITTALS

A. Samples: Submit for approval representative samples of bolts, anchors and inserts as may be requested by the Engineer. His review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of Contractor.

B. Shop Drawings: Submit for approval the following:

1. Setting drawings and templates for location and installation of anchorage devices.

2. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.

B. Determine design loads as follows:

1. Use the design load recommended by the manufacturer and approved by the Engineer.

2.2 MATERIALS

A. Masonry Anchors:

1. Provide carbon steel anchors, as shown on Contract Drawings.

2. Product and Manufacturer: Provide anchors by one of the following:

a. Hilti, Incorporated.

b. Or approved equal.

B. Adhesive Anchors:

1. Provide 316 stainless steel or carbon steel HVA adhesive anchors as shown on Contract Drawings.

2. Product and Manufacturer:

a. Hilti, Incorporated

b. Or approved equal.

C. Expansion Anchors:

1. Provide 316 stainless steel or carbon steel expansion anchors as shown on Contract Drawings.

2. Product and Manufacturer:

a. Hilti, Incorporated

b. Or approved equal.

D. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by Engineer.

E. Connection Bolts, Nuts and Washers: Materials shall be as specified in other Sections of the Specifications, or shown on the Drawings. Where materials are not specified or shown on the Drawings, they shall be of Type 304 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.

B. Assure that embedded items are protected from damage and are not filled in with concrete.

C. Adhesive anchors shall be used as shown or approved by the Engineer.

D. Unless otherwise shown or approved by Engineer conform to following for expansion anchors:

1. Minimum embedment depth in concrete: Mfr. Recommendations.

2. Minimum anchor spacing on centers: Mfr. Recommendations.

3. Minimum distance to edge of concrete: Mfr. Recommendations.

4. Increase dimensions above to develop the full anchor load capacity.

3.2 CLEANING

A. After embedding concrete is placed, remove protection and clean bolts and inserts.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related

work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00, Submittal Procedures

B. Section 01 74 00, Cleaning and Waste Management

C. Section 09 90 00, Painting

1.2 REFERENCES

A. Standards: Comply with the following unless otherwise specified or indicated on the Drawings:

1. Lumber: American Softwood Lumber Standard PS 20 by the U.S. Department of Commerce. Comply with applicable provisions for each indicated use.

2. Plywood: Product Standard PS 1 for Softwood Plywood, Construction and Industrial by the U.S. Department of Commerce.

3. Plywood Installation: APA Design/Construction Guide, Residential & Commercial by the American Plywood Association (APA).

4. Grading Rules:

a. Douglas Fir, Hem-Fir, Idaho White Pine, and other Western Woods: Western Wood Products Association (WWPA) or West Coast Lumber Inspection Bureau (WCLIB).

b. Southern Pine: Southern Pine Inspection Bureau (SPIB).

c. Redwood: Redwood Inspection Service (RIS).

d. Spruce-Pine-Fir: National Lumber Grades Authority (NLGA).

5. User Specification for Treated Wood, American Wood Protection Association Standard (AWPA) U1-02.

6. Framing Installation: American Forest and Paper Association (AFPA).

7. ICC Evaluation Service, Inc.; ESR-1721.

8. LEED Certification: Forest Stewardship Council (FSC) Principles and Criteria

1.3 SUBMITTALS

A. Quality Control Submittals:

1. Certificates: Certification for the following wood treatments:

a. Pressure Treatment: Certification by treating plant stating chemicals and process used, net amount of chemical preservative retained, and conformance with specified standards.

b. Waterbourne Preservatives: Certified written statement that moisture content of treated materials was reduced to a maximum of 19 percent prior to shipment to Project site.

c. Fire-Retardant Treatment: Certification by treating plant stating treated material complies with specified standards and treatment will not bleed through specified finishes.

1.4 QUALITY ASSURANCE

A. Mill and Producers Mark: Each piece of lumber and plywood shall be gradestamped indicating type, grade, mill, and grading agency certified by the Board of Review of the American Lumber Standards Committee. Mark shall appear on unfinished surface, or ends of pieces with finished surfaces.

1. Pressure Preservative Treated Material: Accredited agency quality mark on each piece of wood indicating treatment.

2. Fire-Retardant Treated Material: Accredited testing agency mark on each piece of wood indicating compliance with the fire hazard classification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Keep materials dry during delivery. Store materials 6 inches minimum height above ground surface. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation between stacks.

B. Cover stored materials until ready for use for protection from moisture. Place and anchor cover in a manner that will provide good ventilation under the covering.

1.6 PROJECT CONDITIONS

A. Correlate location of supporting members to allow proper attachment of other Work.

PART 2 - PRODUCTS

2.1 LUMBER

A. General: Furnish FSC certified wood products only, with all pieces stamped with the FSC Label. Furnish seasoned dimension lumber dressed to nominal sizes indicated with 19 percent maximum moisture content at time of dressing, marked "S-DRY". Comply with dry size requirements of PS 20.

1. Dress: Surfaced 4 sides (S4S) unless otherwise indicated.

B. Framing Lumber: Species: Douglas Fir or Hem-Fir (WWPA or WCLIB), Southern Pine (SPIB), Redwood (RIS), or Spruce-Pine-Fir (NLGA) unless otherwise indicated.

1. Light Framing; 2 inches through 4 inches thick, less than 6 inches wide:

a. Stud grade lumber for stud framing and Standard grade lumber for other light framing.

2. Structural Framing; 2 inches through 4 inches thick, 6 inches and wider:

a. Select Structural grade.

3. Exposed Framing; 2 inches through 4 inches thick: Furnish the following species and grade where framing will not be concealed by other Work:

a. Douglas Fir, Select Structural grade (WWPA or WCLIB).

C. Board Lumber; less than 2 inches thick:

1. Exposed Board Lumber, for Paint Finish: Southern Pine No. 1 (SPIB), Douglas Fir 2 Common (WWPA) or Select Merchantable (WCLIB), Redwood Construction Common (RIS), or Spruce-Pine-Fir No. 1 / No. 2 (NLGA).

2. Exposed Board Lumber, for Transparent Finish: Redwood Clear (RIS).

3. Concealed Board Lumber: Southern Pine No. 3 (SPIB), any species No. 4 (WWPA) or any species Standard (WCLIB), Redwood Merchantable (RIS), or Spruce-Pine-Fir No. 1 / No. 2 (NLGA).

D. Miscellaneous Lumber: Standard grade, No. 3 grade, or better grade of the following species unless otherwise indicated:

1. Nailers and Blocking: Douglas Fir, Hem-Fir, Idaho White Pine, Southern Pine, or Spruce-Pine-Fir.

2. Furring: Douglas Fir, Southern Pine, or Spruce-Pine-Fir.

3. Plaster Grounds:

   a. Interior Use: Douglas Fir, Southern Pine, or Spruce-Pine-Fir.

   b. Exterior Use: White Oak, Douglas Fir or approved equal.

2.2 PLYWOOD (where applicable and indicated on drawings)

A. Sheathing and Subflooring: APA RATED SHEATHING, EXPOSURE 1. Furnish APA PS 1 veneered panels, with span ratings for the required thicknesses as listed below unless otherwise indicated.

THICKNESS	SPAN RATING
3/8 inch	24/0
1/2 inch	32/16
5/8 inch	40/20
3/4 inch	48/24

B. Underlayment: APA UNDERLAYMENT, EXPOSURE 1.

1. For use under resilient tile flooring and resilient sheet flooring: Sanded face.

2. For use under carpet and "liquid" flooring: Touch-sanded.

2.3 PARTICLEBOARD

A. Underlayment: ANSI A 208.1, Type 1, Density Range M (40 lb/cu ft minimum average).

2.4 HARDBOARD

A. Hardboard: PS 58, Class "Tempered", S1S, plain board.

2.5 MISCELLANEOUS MATERIALS

A. Underlayment Patching Compound: Hardsetting, quicksetting type with latex or polyvinyl acetate binder.

B. Asphalt Felt: Asphalt-saturated felt, No. 15, without perforations, complying with ASTM D 226.

C. Rosin Paper: Commercial, rosin-sized building paper, 0.010 inch thick.

2.6 PRESERVATIVE TREATMENT

A. Treat lumber and plywood where indicated and as specified. Comply with applicable AWPA U1 Standards and quality control and inspection requirements.

1. Fasteners and anchoring devices to be used with wood treated with waterbourne preservatives shall be hot-dipped galvanized or stainless steel if the wood will be exposed to moisture.

B. Complete fabrication of items to be treated to the greatest extent possible prior to treatment. Where items must be cut after treatment, coat cut surfaces with heavy brush coat of the same chemical used for treatment or other solution recommended by AWPA Standards for the treatment.

C. Inspect wood after treating and drying. Discard warped or twisted items.

D. Wood Treatment: Compatible with galvanized metal connector plates, unless other compatible protective finish for connector plates is approved by the Director for use with approved treatment.

1. Preservative Treatment: Category UC3A for Exterior Construction above Ground; coated and exposed to rapid water runoff.

2. Nailers, blocking, furring, stripping, and similar concealed members in contact with exterior masonry and concrete (including interior wythe of exterior walls), and all sills for framing.

3. Wood items indicated or scheduled on the Drawings to be preservative treated.

E. Wood Treatment: Compatible with galvanized metal connector plates, unless other compatible protective finish for connector plates is approved by the Director for use with approved treatment.

1. Preservative Treatment: Category UC4A for Ground Contact or Freshwater; Non-critical components.

2.7 FIRE-RETARDANT TREATMENT

A. Furnish “FR-S” lumber where indicated, complying with AWPA U1 Standards for pressure impregnation with fire-retardant chemicals to achieve a flamespread rating of 25 or less, when tested in accordance with UL Test 723, ASTM E 84 or NFPA Test 255.

1. Where treated items are indicated to receive a transparent or paint finish, use a fire-retardant treatment which will not bleed through or adversely affect bond of finish.

2. Provide UL label or identifying mark on each piece of fire-retardant lumber.

3. Redry treated items to a maximum moisture content of 19 percent after treatment.

2.8 FRAMING HARDWARE (where applicable)

A. Fasteners and Anchoring Devices: Select and furnish items of type, size, style, grade, and class as required for secure installation of the Work. Items shall be Hot Dip galvanized or stainless steel for exterior use. Items exposed to treated wood shall be Hot-Dip galvanized conforming to ASTM Standard A653; Class G-185 or AISI 304 or AISI 316 stainless steel. Unless shown or specified otherwise, comply with the following:

1. Nails, Screws, Lag Screws/Lag Bolts, Bolts/Nuts/Washers:

a. Hot-Dip galvanized, ASTM Standard A653; Class G-185.

b. Stainless steel AISI 304 or AISI 316.

c. Zinc or cadmium plated.

d. Silicon bronze.

2. Expansion Anchors: Hot-Dip galvanized steel wedge anchors, ASTM Standard A653; Class G-185.

3. Toggle Bolts: Cadmium or zinc plated tumble - wing type.

4. Self Threading Masonry Screws: Zinc Plated; “Tapcon” by Elco Industries, Inc., 1111 Samuelson Rd., PO Box 7009, Rockford, IL 61125-7009, (815) 397-5151.

5. Bar or Strap Anchors: ASTM A575 carbon steel bars.

6. Wall Plugs: Corrugated type, galvanized steel, 24 USS gage min, not less than 2 inches wide x 2-1/2 inches deep.

7. Cross Bridging: Nailable type, galvanized steel, 16 USS gage min, by 3/4 inch wide.

8. Metal Hangers and Framing Anchors: Size and type for intended use, galvanized finish, manufacturer’s recommended fasteners. Items exposed

to treated wood shall be Hot-Dip galvanized conforming to ASTM Standard A653; Class G-185 and epoxy coated in the field.

9. Buck Anchors: Corrugated type, galvanized steel not lighter than 12 USS gage min, 4 inches wide (except where partitions are less than 4 inches thick) by 8 inches long, punched for two 5/16 inch carriage bolts at buck end.

10. Sleeper Anchors: Approved type, galvanized steel not lighter than 20 USS gage min, not less than 1-1/4 inches wide, designed to anchor into concrete not less than 1-1/2 inches and permit height adjustment of sleeper.

11. Stainless Steel Anchors: AISI 304 or AISI 316; Applications include permanent wood foundations and corrosive environments such as saltwater spray and preservative treated wood.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine substrate and supporting structure on which rough carpentry is to be installed for defects that will adversely affect the execution and quality of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION - GENERAL

A. Do not use units of material with defects which impair the quality of the Work and units which are too small to fabricate the Work with minimum joints or with optimum joint arrangement.

B. Install Work accurately to required lines and levels with members plumb and true, accurately cut and fitted and securely fastened. Closely fit rough carpentry to other associated construction.

C. Securely attach carpentry Work to substrates by anchoring and fastening as indicated or, if not indicated, as required by the referenced standards. Select fasteners of size that will not penetrate through members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required. Set nail heads in exposed Work which is to be painted or stained and fill resulting holes.

D. Treated Wood: Apply heavy brush coat of treatment material to field cut surfaces.

3.3 WOOD FRAMING (where applicable)

A. Install framing members of nominal sizes indicated or of units built-up to dimensions indicated, on spacings shown. Unless otherwise indicated, comply with the recommendations of the AFPA "Manual for Wood Frame Construction". Construct required openings for installation of related work. Do not splice structural members between supports.

B. Anchor and nail members as indicated. If not indicated, comply with the "Recommended Nailing Schedule - Table 1" of the "Manual for Wood Frame Construction" and other applicable recommendations of the AFPA.

C. Install miscellaneous blocking and framing indicated and as required for attachment and support of facing materials, fixtures, specialty items, and trim.

3.4 WOOD NAILERS, BLOCKING, AND GROUNDS

A. Install required items where indicated and where required for support, attachment or screeding of other Work. Form to shapes indicated or required. Coordinate locations and cut and shim as required to provide items at true and level planes to receive Work to be attached. Install closure strips for nailers at all edges.

3.5 PLYWOOD SHEATHING, SUBFLOORING, AND UNDERLAYMENT (where applicable)

A. Comply with printed installation requirements of the APA Design/ Construction Guide, Residential & Commercial for plywood application required, unless otherwise indicated.

B. Plywood Underlayment: Install underlayment just prior to installation of finish flooring. Stagger end joints between panels in relation to each other and stagger all joints in relation to substrate jointing. Allow 1/32 inch space between panel ends and edges for expansion. Fasten in accordance with APA recommendations. Prior to installation of finish flooring, patch damaged areas wider than 1/16 inch. Set nails 1/16 inch, but do not fill. Sand rough areas smooth and uneven joints flush.

3.6 PARTICLEBOARD UNDERLAYMENT (where applicable)

A. Install underlayment in accordance with National Particleboard Association recommendations for the type of subfloor condition. Fasten to subflooring in accordance with APA recommendations. Patch and sand gouges, gaps, and chipped edges. Sand uneven joints flush.

1. Nail underlayment to subflooring.

3.7 WOOD FURRING

A. Install members plumb and level with closure strips at all edges. Shim with wood as required to achieve tolerance specified.

1. Fastening: Attach to substrates as indicated; if not indicated, attach material as specified for nailers and blocking.

2. Tolerance: Shim and level wood furring to a tolerance of 1/8 inch in 10 feet.

3. Firestop furred spaces on walls at each floor level, with wood blocking or other approved non-combustible materials. Fit members accurately to close furred spaces.

4. Furring to Receive Plywood Paneling: Unless otherwise indicated, 1 x 3 inch furring at 2 feet oc, horizontally and vertically.

5. Furring to Receive Gypsum Drywall: Unless otherwise indicated, 1 x 2 inch furring at 16 inches oc, vertically.

6. Furring to Receive Plaster Lath: Unless otherwise indicated, 1 x 2 inch furring at 16 inches oc, vertically.

7. Suspended Furring: Size and spacing indicated, including hangers and attachment devices.

3.8 FLOOR SLEEPERS (where applicable)

A. Unless otherwise indicated, install 3 x 3 inch strips, 12 inches oc and across abutting walls and restricting features. Anchor to slab with sleeper anchors 16 inches oc. Shim level to required height with redwood wedges 8 inches oc. Fill space between sleepers and floor slab solid with 1 part Portland cement and 2-1/2 parts sand mortar.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related

work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 07 21 00

INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as required to provide insulation as shown and specified.

2. The extent of each type of insulation Work is shown on the Contract Drawings or specified herein.

3. The types of insulation required include the following:

a. Fiberglass batt insulation at ceiling joists.

b. Polystyrene insulation.

B. Related Work Specified Elsewhere:

1. Section 042010, Unit Masonry Construction.

2. Section 061000, Rough Carpentry.

1.2 QUALITY ASSURANCE

A. Design Criteria: Thermal Conductivity: The thicknesses shown are for the thermal conductivity, k-value at 75 degrees F., specified for each material. Provide adjusted thicknesses as directed for the use of material having a different thermal conductivity.

B. Requirements of Regulatory Agencies: Comply with fire-resistance and flammability ratings as shown and specified; and comply with applicable requirements of the New York State Uniform Fire Prevention and Building Code.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM C518, Thermal Conductivity of Materials by Means of Heat Flow Meter.

2. ASTM D2842, Water Absorption of Rigid Cellular Plastics.

3. ASTM E84, Surface Burning Characteristics of Building Materials.

4. ASTM E119, Fire Tests of Building Construction and Materials.

5. FS HH-I-521F, Mineral Fiber, Insulation Blanket.

6. FS HH-I-558B, Thermal Insulation.

7. FS HH-I-574B, Insulation, Thermal (Perlite).

8. ASTM E2178 Standard Test Method for Air Permeance of Building Materials - leakage rates less than 0.001 L/s/m2 at a test pressure of 75 Pa.

9. ASTM E283 Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under specified Pressure differences across the specimen. Results were <0.02 L/s/m2.

10. 10.ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies - no leakage.

11. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference - no leakage.

12. 2009 International Building Code (IBC) Section 2603

13. ICC-ES ESR-1659

14. THERMAX™ products are covered under Underwriters Laboratories Inc. (UL) File R5622.

D. Reference standards for rigid insulation:

1. THERMAX™ Sheathing meets ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board, Type I, Class 2. Applicable standards include:

   a. C203 – Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.

   b. C209 – Standard Test Methods for Cellulosic Fiber Insulating Board,

c. C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus,

d. D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics,

e. D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging,

f. E96 – Standard Test Method for Water Vapor Transmission of Materials,

g. D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics

1.3 SUBMITTALS

A. Manufacturer's Data: Submit for approval copies of manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that the materials comply with specified requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver all materials in unopened, undamaged original packaging bearing the manufacturer's labels.

B. Storage of Material:

1. Protect insulation materials from becoming wet or soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

2. Handle all materials with proper care to prevent damage from any source.

3. Insulation must be kept dry at all times. If stored outside, raise insulation aboveground or roof level on pallets and cover with a tarpaulin or other waterproof material. Plastic wrapping installed and they should not be used as outside storage covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fiberglass Insulation:

1. Fiberglass insulation shall be installed within ceiling as shown and indicated on dwgs.

2. Insulation shall conform to Federal Specification HH-I-521F, Type II, Class A.

3. Insulation shall have a minimum R value as indicated on dwgs and shall include a vapor barrier at ceiling side only.

4. Insulation shall be secured in place with galvanized T-50 staples as recommended by the insulation manufacturer. Vapor barrier shall be towards the interior of the building. Insulation shall be stored in a dry place and shall be protected from the weather at all times.

5. Manufacturer:

   a. Johns Manville

   b. Or equal

B. Wall Batt Insulation

1. The insulation system shall have a minimum thickness of 2 inches and an "R" value as indicated on dwgs.

   a. Product and Manufacturer: Batt Insulation shall be manufactured by:

      1) Owens Corning

      2) Or approved equal.

C. Polyiso Rigid Insulation

1. 2" rigid insulation or as otherwise indicated on drawings.

2. R value of R-10 as indicated on drawings for equipment room.

3. Glass-fiber-infused polyisocyanurate foam core laminated between 1.0 mil smooth, reflective aluminum facers on both sides.

4. Product and Manufacturer:

   a. Dow Chemical, THERMAX sheathing

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor shall examine the substrate and conditions under which the insulation Work is to be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the insulation Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

3.3 INSPECTION AND ACCEPTANCE

A. Insulation which has become wet, damaged, or deteriorated, as determined by the Engineer, shall be promptly removed from the job.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 07 26 13

VAPOR RETARDER UNDER SLABS ON GRADE

PART 1 – GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00, Cast-In-Place Concrete

1.2 REFERENCES

A. Standard Referenced in this Section are:

1. ASTM D 882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

2. ASTM D 1709 Standard Test Methods of Impact Resistance of Plastic Film by the Free-Falling Dart Method.

3. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.

4. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.

5. ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

6. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

A. Product Data: Catalog sheets, specifications, and installation instructions for each material specified.

1. Samples:

a. Vapor Retarder Material: 12 inches square.

b. Pressure-Sensitive Tape: 36-inch-long piece minimum.

PART2 – PRODUCTS

2.1 MATERIALS

A. Vapor Retarder: Extruded single-ply or multi-ply type; polyethylene or polyolefin.

1. Water-Vapor Permeance (ASTM E 96 or ASTM E 154): 0.04 perms or less.

2. Class Rating (ASTM E 1745): A.

3. Tensile Strength (ASTM E 154 or ASTM D 882): 45 lbf./in. or higher.

4. Puncture resistance (ASTM D 1709): 2200 g or higher.

5. Thickness: 10 mils minimum.

6. Acceptable Products:

a. "Moistop Ultra 10" by Fortifiber Building Systems Group.

b. "Vapor Block 10" by Raven Industries, Inc.

c. "Stego Wrap 10-Mil Vapor Barrier" by Stego Industries, LLC.

d. "Perminator 10 Mil Underslab Vapor-Mat" by W. R. Meadows, Inc.

B. Pressure-Sensitive Tape/Adhesive: Vapor retarder manufacturer's standard or recommended materials.

C. Pipe Boots: Vapor retarder manufacturer's standard pipe boots, or construct pipe boots from vapor retarder material, pressure-sensitive tape and/or adhesive, in accordance with vapor retarder manufacturer's instructions

PART 3 - EXECUTION

3.1 PREPARATION

D. Surface Preparation: Rake, trim, and tamp surfaces over which vapor retarder is to be installed to true planes and as required to make a surface that will not puncture the vapor retarder material.

3.2 INSTALLATION

A. Install vapor retarder in accordance with manufacturer's printed instructions and ASTM E 1643. Lap seams and joints a minimum of 6 inches and seal with adhesive or pressure-sensitive tape.

B. Lap vapor retarder over footings and seal to foundation walls.

C. Seal penetrations, including pipes, with pipe boots.

3.3 PROTECTION

A. Protect vapor retarder as required so that it will be in sound condition, free from punctures and tears, at the time the concrete is placed.

3.4 REPAIR

A. Repair tears and punctures with a piece of vapor retarder material, overlapping the tear or puncture a minimum of six inches on all sides, and completely seal edges with pressure-sensitive tape or adhesive.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 07 28 00

WATER RESISTIVE BARRIER AND AIR BARRIER

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00, Submittal Procedures

B. Section 01 74 00, Cleaning and Waste Management

C. Section 06 10 00, Rough Carpentry

1.2 DEFINITIONS

A. Section includes vapor-permeable, fluid-applied air and water barriers.

B. Weather Barrier: A combination of materials and accessories that do the following:

1. Prevent the accumulation of water as a water-resistive barrier.

2. Minimize the air leakage into or out of the building envelope as a continuous air barrier.

3. Provide sufficient water vapor transmission to enable drying as a vapor permeable membrane.

1.3 REFERENCES

A. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly in accordance with IBC Section 1403.2.

1. Primary Layer: Water-resistive barrier (fluid-applied) installed closest to building interior with all flashings and terminations integrated to this layer.

B. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of building envelope in accordance with ASHRAE 90.1 Section 5.4.3.1.

C. Vapor-Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96 in accordance with definition in

International Building Code. Vapor-permeable material permits passage of moisture vapor through vapor diffusion.

D. Conformance to test parameters:

1. ASTM E2357 Section A2.2.1.2 Specimen 2 for penetrated assemblies.

a. ASTM E 331 Test Parameters.

b. AAMA 501.1 Test.

c. ASTM E 330 Test

d. AAMA 501.5 Test Parameters:

1.4 SUBMITTALS

A. Product Data:

1. For weather barrier, include data on air and water-vapor permeance based on testing in accordance with referenced standards.

2. Catalog sheets, specifications, and installation instructions for each material specified.

B. Sustainable Design Submittals (where applicable)

1. Test Reports: Envelope testing and verification of the following:

a. Water-Spray Test.

b. Air Infiltration Test.

c. Water Penetration Test.

2. Product Data: Including the following information:

a. Provide Health Product Declarations (HPDs).

b. Provide Environmental Product Declarations (EPD's).

c. SDS (formerly MSDS), third-party certifications, or product technical data confirming systems that meet or exceed emissions guidelines for volatile organic compounds (VOCs) and hazardous air pollutants (HAPs), as follows:

1) Commercial weather barrier complies with California Department of Public Health (CDPH) Standard.

2) Adhesives and sealants wet-applied on-site that meet/exceed VOC content requirements for wet applied products comply with SCAQMD Rule 1168.

3) Flashing systems comply with SCAQMD Rule 1168 on VOC limits.

C. Preconstruction Laboratory Mockup Testing Submittals: (where applicable as approved by Architect)

1. Owner/Architect's representative in a third-party testing program: Develop specifically for Project.

2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.

3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

D. Shop Drawings:

1. Show details of weather barrier at terminations, openings, and penetrations.

2. Show details of weather barrier applications.

1.5 INSTALLATION

A. Manufacturer's Instructions: For installation of each product specified.

B. Qualification Data: For Installer and laboratory mockup testing agency and field testing agency.

C. Sample Warranty: For manufacturer's warranty.

D. Reports: Field test and inspection reports.

E. Installer's weather barrier manufacturer training certificate.

F. Shop Drawings:

1. Show details of weather barrier at terminations, openings, and penetrations.

2. Show details of weather barrier applications.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to install manufacturer's product.

B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025].

C. Mockups: (where applicable as approved by Architect) Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly as indicated on dwgs, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

    a. If Architect determines that mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preconstruction Laboratory Mockups: (where applicable as approved by Architect)

1. Preconstruction Testing Service: Owner/Architect's representative will engage a qualified testing agency to perform testing on preconstruction laboratory mockups.

2. Manufacturer's Field Service: Register Project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project Registration and Observation process.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

C. Store in a dry environment between 50 and 80 deg F.

1.8 WARRANTY

A. Manufacturer's Product Warranty: Manufacturer agrees to repair or replace weather barrier product that fails in materials within specified warranty period.

1. Warranty Period: 10 years from date of product purchase.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

1. DuPont Safety & Construction: E. I. du Pont de Nemours and Company, Rochester, NY www.dupont.com

2. W.R. Meadows Sealtight Air Shield LMP., water-based air/liquid moisture barrier.

3. WR Meadows, Inc. PO Box 338 Hampshire, Ill. www.wrmeadows.com

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures, without failure due to defective manufacture of products.

B. High-Performance Installations:

1. For installation with one of the following building envelope performance or structural characteristics:

a. Exceeding 65 mph equivalent structural load.

b. Exceeding 15 mph equivalent wind-driven rain water infiltration.

c. Buildings with 60 feet or more total height above grade plane, as defined by the IBC.

d. Construction with gypsum or cement-based exterior sheathing.

e. Non-wood based primary structure such as steel, light-gauge steel, masonry, or concrete.

C. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Fluid Applied WB+™ or comparable product by one of the following:

W.R. Meadows Sealtight Air Shield LMP., water-based air/liquid moisture barrier.

1. Solids Content, %: 58

2. Color: Gray

3. (Black – special order only)

4. Flexibility @ -26° C (-15° F),PASS

5. (ASTM C 836):

6. Elongation (ASTM D 412), %: 1300

7. Water Vapor Permeance 12

8. (ASTM E 96, Procedure B) Perms:

9. Service Temperature: Not to exceed 175° F

10. (80° C)

11. Nail Sealability (ASTM D 1970): Pass

12. Storage Temperature 40 – 90° F (4 – 32° C)

13. Air/Substrate Temperature (At Time of Application): >20° F (-6.7° C)

14. Air leakage Test Method ASTM E 2178 ASTM E 2357

15. Pressure 75 Pa

16. (1.57 lb./ft.2) 75 Pa

17. (1.57 lb./ft.2)

18. ABAA Requirements 0.004 cfm/ft.2 (0.02 L/S/M2)0.04 cfm/ft.2

19. (0.2 L/S/M2)

20. AIR-SHIELD LMP Results <0.004 cfm/ft.2 (0.02 L/S/M2) <0.04 cfm/ft.2

21. (0.2 L/S/M2)

D. Fluid-Applied Membrane: ASTM E 2357 passed, Air Barrier Association of America (ABAA) evaluated air barrier assembly, and assembly water resistance in accordance with ASTM E 331; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E 84; UV stabilized for nine-month exposure; and acceptable to authorities having jurisdiction.

2.3 WEATHER BARRIER FLASHING

A. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; FlexWrap™ NF or comparable product by one of the following:

1. WR Meadows

B. Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners. ASTM E 331 applies to water penetration testing of exterior windows, skylights, doors, and curtain walls.

C. Water Penetration: No leakage at 15 psf (720 Pa) in accordance with ASTM E 331.

D. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg F (-4 deg C) as Class A (without primer use).

E. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3 Test B.

F. Strip Flashing: Composite flashing material composed of spunbonded polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure of 176 deg F (80 deg C) for seven days.

G. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® StraightFlash™ Tyvek® StraightFlash™ VF] or comparable product by one of the following:

1. WR Meadows

H. Water Penetration: No leakage at 15 psf (720 Pa) in accordance with ASTM E 331.

I. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg F (-4 deg C) as Class A without primer use.

J. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3 Test B.

K. Primer for Flashings: Synthetic rubber-based product. Spray applied. Strengthen the adhesive bond at low temperature applications between weather products, such as self-adhered Flashing Products, Commercial Building Wraps, and common building sheathing materials.

L. Basis of Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; DuPont™ Adhesive Primer or comparable product by one of the following.

1. WR Meadows

M. Peel Adhesion Test: Passes ASTM D 3330, Test Method F, for the following:

1. Peel Angles: 0, 25, 72, and 180 degrees.

2. Substrates: Concrete masonry units (CMU), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.

N. Chemical Compatibility per AAMA 713: Pass.

O. Flame Spread Index per ASTM E 84: 5.

P. Smoke Development Index per ASTM E 84: 0.

2.4 FLUID APPLIED FLASHING AND SEALANT (where applicable)

A. Fluid Applied Flashing: Trowel or brush applied, non-water soluble, single component, silyl terminated polyether technology (STPE), vapor permeable, flashing material.

1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Fluid Applied Flashing and Joint Compound+ or comparable product by one of the following:

a. WR Meadows

2. VOC Content: ASTM C 1250, less than 2 percent by weight and less than 30 g/L.

3. Water Vapor Transmission: ASTM E 96, Method B, greater than 20 perms at 25 mils (0.64 mm) thick.

4. Minimum Tensile Strength: ASTM D 412, 165 psi (1140 kPa).

5. Minimum Elongation at Break: ASTM D 412, 360 percent.

B. Fluid Applied Sealant: ASTM C 920

1. Extension-Recovery/Adhesion per ASTM C 736: 100 percent recovery.

2. Accelerated Weathering/Low Temperature Flexibility per ASTM C 793: Pass.

3. VOC Percentage by Weight per ASTM C 1250: Less than 2 percent.

4. VOC per ASTM C 1250: Less than 30 g/L.

2.5 DRAINAGE LAYER

A. Drainage Layer: Weather barrier membrane with drainage.

1. Basis-of-Design Product: DuPont Safety & Construction: E. I. du Pont de Nemours and Company; Tyvek® Fluid Applied WB+™ and CommercialWrap® D or comparable product by one of the following:

a. WR Meadows

2. Drainability: 98 percent or greater when tested in accordance with ASTM E 2273.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that substrates have cured and aged for minimum time recommended in writing by weather barrier manufacturer.

3. Verify that substrates are visibly dry and frost-free.

a. Fluid-applied weather barrier may be applied to damp surfaces.

b. Surfaces are considered damp if there is no visible water on the surface, and no transfer of water to the skin when touched.

c. Apply accessory products only to clean and dry surfaces.

4. Verify that substrates are free of efflorescence and mold.

5. Verify that masonry joints are flush and filled with mortar.

6. Verify that top-of-wall system has been capped or covered to prevent water getting behind the facade and into wall cavity.

7. Verify continuous path for moisture drainage.

   a. Verify that continuous path for drainage is not blocked or disrupted, which results in excess moisture buildup in wall cavity.

8. Verify that surfaces to receive weather barrier are above grade.

B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation.

   1. Verify that rough sill framing for doors and windows slopes downward towards the exterior and is level across width of opening.

C. Verify air and surface temperatures are above 25 deg F (4 deg C) with a maximum surface temperature of 140 deg F (60 deg C). Do not install once ambient temperature exceeds 95 deg F (35 deg C), unless surface is shaded.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions. (where applicable)

E. 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.

F. 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.

G. When spraying is method of application, taper ends of the joint treatment to assist maintaining a wall system free of pinholes and voids.

H. Treat all non-moving transition joints to beams, columns, and dissimilar materials by applying a 2-inch- (50-mm-) wide by 60-mil- (1.5-mm-) thick coat of fluid-applied flashing across the joint.

I. Apply 25-mil- (0.6-mm-) thick coat of fluid-applied flashing, extending a minimum 2 inches (51 mm) on each surface, and treat the following conditions:

1. Joints up to 1/4 inch (6 mm).

2. Joints 1/4- to 1/2-inch (6- to 13-mm); reinforce with fiberglass-mesh tape.

3. Joints and transitions up to 1 inch (25 mm); treat using strip flashing.

J. Bridge [isolation joints] [expansion joints] [and] discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

K. When spraying is method of application, taper ends of fluid applied corner treatment to wall substrate.

L. Treat inside and outside corners by applying a 25-mil- (0.6-mm-) thick coat of fluid applied weather barrier a minimum 2 inches (50 mm) on each adjoining surface. Apply fillet bead of fluid-applied sealant to inside corners to ensure continuity. Alternatively, treat corners using strip flashing. Press strip flashing into inside corners; ensure that it is fully adhered to substrate.

M. Seal penetrations using fluid-applied flashing or sealant. Extend fillet bead 1/2 inch (13 mm) onto both surfaces.

N. Treat embedded masonry anchors by applying a coat of fluid-applied weather barrier or fluid-applied flashing around base of the anchor.

3.3 ACCESSORIES INSTALLATION (where applicable and indicated on drawings)

A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

2. Install transition strip on roofing membrane or base flashing, for a minimum 3 inches (75 mm) coverage over each substrate.

3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow to dry.

4. Use recommended primer when applying self-adhered flashing products on concrete, masonry, and fiber faced exterior gypsum board substrates. Priming is generally not required for adhering self-adhered flashing products to wood. However, adverse weather conditions or colder temperatures may require a primer to promote adhesion. Priming is not required when applying fluid-applied products, except on cut edges of exterior gypsum sheathing.

5. Apply pressure along entire surface of strip flashing for good bond using a J-roller or firm hand pressure. Remove all wrinkles and bubbles by smoothing surface and repositioning as necessary.

B. Connect and seal exterior wall air-barrier material 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.

C. When applying self-adhered flashing products over a cured fluid-applied membrane, first apply a wet bed of fluid-applied product.

D. Seal fasteners of mechanically attached supports or furring strips in high-performance building envelope designs.

1. Apply double-sided butyl tape to back of support bracket at fastener location.

2. Embed support bracket into an additional wet bed of fluid applied product.

3. Adhere butyl-based flashing patch to wall at fastener location.

4. Use alternate method as approved by the manufacturer.

E. At end of each working day, seal top edge of strips and transition strips to substrate with manufacturer approved product.

F. 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.

G. Flashing Sill Area for Windows and Doors: (where applicable and as indicated on dwgs)

1. Use 6-inch- (150-mm-) wide conformable flashing for 2- by 4-inch (50- by 100-mm) framing and 9-inch- (220-mm-) wide conformable flashing

for 2- by 6-inch (50- by 150-mm) framing. When rigid back dams are required or desired, one option to use is a 3/4-inch (19 mm) corner guard (back dam), cut to length of sill, and nailed into place on interior edge of sill prior to installation of 9-inch- (220-mm-) wide conformable flashing. Afterward, install 9-inch- (220-mm-) wide conformable flashing over sill and corner guard back dam.

2. Install without stretching conformable flashing when installing along sills or jambs. Conformable flashing is intended to be stretched when covering corners or curved sections.

H. Apply fluid-applied flashing products from head of opening down. Use a corner trowel to smooth corners.

I. Repairs:

1. Coat small damaged areas with layer of fluid-applied product.

2. Reinforce large damaged areas with fiberglass mesh or replace damaged substrate before reapplying fluid-applied product.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips, and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

4. Fluid applied products may be overcoated once a touch-free skin has formed. Exterior insulation and cladding may be installed once the membrane has cured sufficiently to resist damage during installation.

B. Apply air barrier material in accordance with air-barrier manufacturer's written instructions and recommendations. (where applicable)

1. Roller Application:

a. Nap rolling: Use a roller cover with a 1/2- to 3/4-inch (13- to 19-mm) nap.

2. Spray Application:

a. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

b. Use spray guard.

c. Back Rolling: Use a roller cover with a 1-1/2- to 3/4-inch (13- to 19-mm) nap. Apply fluid-applied product in a single coat at 25 mils (0.64 mm) thick. Control thickness by applying appropriate volume over a marked area and spot checking with a wet-mil gauge.

C. Integrate fluid-applied product with through-wall flashing and window and door flashing by overlapping flashing with fluid-applied product a minimum 2 inches (50 mm).

D. Inspect surfaces to ensure that fluid-applied products are continuous and free of any voids or pinholes.

E. Do not cover air barrier until it has been tested and inspected by the testing agency.

F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.

1. Continuity of air-barrier system has been achieved throughout the building envelope without gaps, holes, or pinholes.

2. Air-barrier dry film thickness.

3. Continuous structural support of air-barrier system provided.

4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.

5. Site conditions for application temperature, and dryness of substrates are maintained.

6. Maximum exposure time of materials to UV deterioration not exceeded.

7. Surfaces primed, where applicable.

8. Laps in strips and transition strips comply with minimum requirements, are shingled in correct direction (or mastic applied on exposed edges), and are without fishmouths.

9. Termination mastic applied on cut edges.

10. Strips and transition strips firmly adhered to substrate.

11. Compatible materials used.

12. Transitions at changes in direction and structural support at gaps provided.

13. Connections between assemblies (air-barrier and sealants) comply with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.

14. Each penetration sealed.

C. Field Quality Control Testing: (where applicable as approved by Owner/Architect's representative) Perform the following tests:

1. Air Infiltration Whole Building: ASTM E 779 at not more than [0.40 cfm/sf (2.00 L/s per sq. m)] [0.25 cfm/sf (1.25 L/s per sq. m)] [0.15 cfm/sf (0.75 L/s per sq. m)] at 1.57 lb/sq. ft. (75 Pa).

2. Water Penetration: ASTM E 1105 at a minimum [uniform] [and] [cyclic] static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article in Part 2, but not less than [2.86 lbf/sq. ft. (137 Pa)] [6.24 lbf/sq. ft. (300 Pa)] [10.4 lbf/sq. ft. (500 Pa)] [12.5 lbf/sq. ft. (600 Pa)]. No water penetration shall occur as defined in ASTM E 1105.

a. Perform a minimum of two tests in areas as directed by Architect. (where applicable)

b. Perform tests in each test area as directed by Architect. Perform a minimum three tests, prior 70 percent completion.

3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D 4541 for each [600 sq. ft. (56 sq. m)] of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.

2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.

2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 07 40 00

ALUMINUM SOFFITS FASCIAS, AND WALL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The General Contractor shall furnish all labor, materials, equipment for a complete installation of aluminum soffits and fascias, and related work shown on drawings and specified herein.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the aluminum soffits and fascias work.

C. Related Work Specified Elsewhere:

1. Section 06 10 00, Rough Carpentry

2. Section 07 71 00, Manufactured Roof Specialties

3. Section 07 92 00, Joint Sealants

1.2 QUALITY ASSURANCE

A. Installer Qualifications:

1. The installer shall be skilled and experienced in the type of aluminum siding work required, and equipped to perform workmanship in accordance with recognized standards.

B. Reference Standards: Comply with applicable provisions and recommendations of the New York State Code reference standards, as well as the indicated manufacturer's specifications, standards and recommendations.

1.3 SUBMITTALS

A. Samples: Submit for approval 12-inch long sample of specified soffit and fascia.

B. Shop Drawings: Submit for approval the following:

1. Shop drawings shown in the method and details of erection.

2. Copies of manufacturers Specifications.

1.4 PRODUCT DELIVERY AND HANDLING

A. Delivery of Materials: Deliver soffits and fascia boards to job in manufacturers original, unopened containers with labels intact and legible.

B. Storage of Materials:

1. Store materials in an area protected from construction traffic.

2. Store materials in same package in which they were shipped.

C. Handling Materials: Protect materials from dents, scratches, warps or bends.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soffit: Fully vented soffit.

B. Fascia: Solid aluminum fascia panels.

C. Wall Panels: Vertical 8" wide.

D. Accessories:

1. J-Channel, F-Channel and trim.

E. Colors: To be chosen by the Owner.

F. Product and Manufacturer:

1. Atlas International, Inc.

2. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prior to commencing work, verify governing dimensions of buildings; examine, clean and repair, if necessary, any adjoining work on which this work is in any way dependent for its proper installation.

B. The field application of soffit, fascia, wall panels, and trim members shall be in accordance with the best practice, with all joint members true and plumb.

C. Soffit, fascia, wall panels and accessories shall be installed in accordance with the latest edition of the manufacturer's installation manual.

D. Items not covered in this specification - as indicated on drawings or as required shall be provided for a complete installation.

3.2 WARRANTY

A. Manufacturer to provide a lifetime limited warranty on the quality of materials.

B. No service charge to inspect complaints.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 07 41 10

ALUMINUM ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal roofing, including flashing and accessories.

B. Metal wall and fascia panels.

C. Metal soffit panels.

1.2 RELATED SECTIONS

A. Section 07 40 00, Aluminum Soffits, Fascias, and Wall Panels

B. Section 07 71 00, Manufactured Roof Specialties

C. Section 07 92 00, Joint Sealants

1.3 REFERENCES

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2001a.

B. ASTM A792 / A792M - Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

C. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2001.

D. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 1991 (Reapproved 1999).

E. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000.

F. ASTM E 408/C - 1371: "Standard Test Method for Total Normal Emittance of Surfaces Using inspection - Meter Techniques.

G. ASTM E 903/C - 1549: Standard Test Method for Solar Absorbtance, using Integrating Spheres.

H. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995.

I. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 1995.

J. Dade County County (Florida) Acceptance Report Numbers: 01-1106-01 and 01-1106-02.

K. FM - Tests Requirements for Class 1 Panel roofs, Factory Mutual Research Corporation.

L. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; 1994.

M. UL2218: Class 4 Impact Resistance Rating.

N. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors National Association; 1993.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Include methods for maintaining installed products and precautions relating to cleaning materials and methods that might be detrimental to finishes and performance.

H. Close Out: Warranty documents specified herein.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer with documented experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.

B. Pre-Installation Meeting: Conduct pre-installation meeting to acquaint installers of roofing and related work with project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging with identification labels intact until ready for installation.

B. Store materials protected from exposure to harmful conditions. Store material in dry, above ground location.

1. Stack pre-finished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture to run off.

2. Prevent contact with material that may cause corrosion, discoloration or staining.

3. Do not expose to direct sunlight or extreme heat trim material with factory applied strippable film.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official covering finish, including color, fade, chalking and film integrity.

B. Warranty Period: 20 years commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ATAS International, Inc.,

B. Or approved equal.

2.2 SHEET METAL ROOFING

A. General: Factory fabricated panels; panels fabricated on site using portable roll former are prohibited.

1. Performance Requirements: Provide sheet metal roofing that has been manufactured, fabricated and installed to achieve the following performance without defects, damage, failure or infiltration of water.

a. Wind Uplift: Provide UL 580 Class 90 rated assembly.

b. FM: Test Requirements for Class 1 panel roofs.

c. Static Air Infiltration: 0.06 cu ft/min/sq ft (1.1 cu m/h/sq m) at 6.24 lb/sq ft (300 Pa) air pressure differential, maximum, when tested in accordance with ASTM E 283 or ASTM E 1680.

d. Water Infiltration: No evidence of water penetration at inward static air pressure differential of 12.0 lb/sq ft (575 kPa), when tested in accordance with ASTM E 331 or ASTM E 1646.

e. Thermal Movement: Accommodate movement expected due to ambient and surface temperature ranges likely to occur at project site.

2. Panel Lengths: As indicated on drawings; panels 55 feet (16.76 m) and less fabricated in one continuous length.

3. Texture: Smooth texture, dull matte specular gloss 25 to 35 percent at 60 degrees F (15.5 degrees C).

4. Finish: Factory applied PAC-CLAD finish:

a. Topside: Full-strength fluoropolymer, 70 percent Kynar 500 or Hylar resin, 1.0 mil (0.025 mm) total dry film thickness.

b. Underside: Wash coat of 0.3 to 0.4 mil (0.076 to 0.1 mm) dry film thickness.

c. Color: As selected by Owner from manufacturer's standard colors.

5. Panel Fasteners: Non-penetrating type, as required to achieve wind uplift rating or otherwise as recommended by manufacturer.

B. Roof Panels: Aluminum flat panels with continuously interlocked standing seam; one-piece design without separate seam cover.

1. Seam Height: 1-1//2 inches (38 mm) minimum.

2. Material: 24 gage, 0.024 inch (0.61 mm) ASTM A792 /A792M Galvalume steel, structural quality.

3. Panel Width: 18 inch (457 mm), center to center.

4. Eave Notching: Factory produced eave notching for trimmed eave panels.

5. Sealant Bead: Factory applied sealant bead.

2.3 ACCESSORY MATERIALS

A. Underlayment: ASTM D 226, Type II No. 30 asphalt saturated organic roofing felt.

B. Plywood Deck: 5/8 inch (16 mm) nominal thickness; as specified in Section 06 10 00 - Rough Carpentry.

C. Nailable Insulation: 1 inch (25 mm) minimum to 3-1/2 inch (89 mm) maximum nominal thickness classified polyisocyanurate foamed plastic, 2 pcf (32 kg/cu m) density, factory laminated to 7/16 inch (11 mm) thick APA rated oriented strand board (OSB).

D. Sealant: Elastomeric.

E. Bituminous Coating: Cold-applied asphaltic mastic, free of asbestos fibers, sulfur, and other harmful impurities.

F. Touch-Up Paint: Approved by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are acceptable for roofing installation in accordance with manufacturer's instructions.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate metal roofing with other work, including but not limited to drainage, flashing and trim, deck substrates, parapets, copings, walls, and other adjoining work.

C. Install metal roofing panels to profiles, patterns and drainage indicated, in accordance with manufacturer's instructions, and as necessary to achieve specified performance and a leak-free Installation. Allow for structural and thermal movement.

D. Separate dissimilar metals using bituminous coating to prevent galvanic action.

E. Use fasteners recommended by panel manufacturer; conceal fasteners wherever possible; cover and seal exposed fasteners.

F. Provide uniform, neat seams; provide sealant-type joint where indicated and form joints to conceal sealant.

3.3 FIELD QUALITY CONTROL

A. Post Installation Testing: Owner reserves right to perform post installation testing of installed sheet metal roofing.

B. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.4 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Touch-up, repair or replace damaged products.

C. Clean in accordance with manufacturer's instructions prior to Substantial Completion.

D. Remove construction debris from project site and legally dispose of debris.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 07 71 00

MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Gutters and Downspouts:

1. Gutter profiles.
2. Square/rectangular downspouts, elbows, and offsets.
3. End caps.
4. Miters.
5. Hangers for downspouts.
6. Conductor heads.

B. Related Sections:

1. Section 07 40 00, Aluminum Soffits, Fascias, and Wall Panels
2. Section 07 41 10, Aluminum Roof Panels
3. Section 07 92 00, Joint Sealants

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A527 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
3. ASTM A568 - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

4. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

B. Shop Drawings: Include materials, details of construction and attachment to adjacent work.

C. Verification Samples: For each product to be provided, two samples, minimum size 6 inches (150 mm) square representing actual product including thickness, color and finish.

1. Anchors: Two, each type required.

2. Cap Flashings: Full section, 6" long.

3. Downspout: Full section, 12" long.

D. Guarantee

E. Certificates of qualifications as specified under Article titled “Quality Assurance”.

F. Product Certificates

1. Certify that materials of this Section, such as copper/fabric flashing, sealants, termination bar, and fasteners, are compatible with all components of the air barrier system and other Project materials that contact them.

1.4 DESIGN REQUIREMENTS

A. Conform to applicable code for size and method of rain water discharge.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section shall be supplied by a single manufacturer with a minimum of ten years' experience.

B. Installer Qualifications: Minimum 2 years experience installing similar products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Store products in clean, dry, sheltered area off the ground until ready for use.

C. Protect products from exposure to direct sunlight and rain. Handle materials to avoid damage.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

1.8 WARRANTY

A. Manufacturers Product Warranty: Provide manufacturer's standard limited warranty that products are free from manufacturing defects and will not break down or deteriorate under normal conditions.

1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Chris Industries: 290 Larkin Ave.; Wheeling, IL 60090; Toll Free Tel: 800-356-7922 ; Tel: 847-729-9292; Fax: 847-729-0340; Web: www.chrisind.com

B. Or approved equal

2.2 MATERIALS

A. Materials: The products listed in this specification are made using materials listed below as applicable and as specified.

1. Galvanized Flat Sheet, Paint grip: G90 galvanized steel. LFQ (lock forming quality). ASTM A527.

2. Stainless Steel Flat Sheet: Alloy 304, Finish 2B, ASTM A240

2.3 SCUPPER, NOZZLE AND DOWNSPOUTS

A. Scupper

1 Manufacturer: OMG 5 inch scupper thru wall retro drain

a. RAC Back□ow Compression Seal - activated at drain flange level to protect the roofing system and building contents from water backup damage.

b. 125-in. metal clamping ring assembly provides a compression type termination for the vertical and horizontal roof flashings. Stainless steel studs and lock nuts secure the clamping ring assembly to the drain flange.

c. .060-in. thick drain strainer secured to the drain body with four stainless steel wing nuts

d. 9-in. stem

B. BRONZE DOWNSPOUT NOZZLE

1. Manufacturer: ZURN

a. Model ZARB199-8-PVC

1. Downspout Material:

2.4 ACCESSORIES

A. Connectors: Furnish required connector pieces for components.

B. Anchors and Supports: Profiled to suit downspouts.

C. Anchoring Devices: In accordance with SMACNA requirements

D. Downspout Supports:

E. Fasteners: As per manufacturer’s recommendations

F. Solder: ASTM B32; Alloy Grade Sn50 type.

2.5 FASTENERS

A. Nails "Stronghold" type large flat head roofing nail.

1. For Copper: Hardened copper.

2. For Stainless Steel: Stainless steel.

B. Screws, Bolts, and other Fastening Accessories

1. For Copper: Copper or brass.

2. For Stainless Steel: Stainless steel type 316.

C. Anchors

Provide one of the following types:

1. Hammer driven anchors, consisting of a stainless steel drive pin and a corrosion resistant metal expansion shield inserted thru a stainless steel disc with an EPDM sealing washer.

D. Self-tapping, corrosion resistant, concrete and masonry screw inserted thru a stainless steel disc with an EPDM sealing washer.

2.6 MISCELLANEOUS MATERIALS

A. Solder

1. Composition of block tin/pig lead of proportion recommended by the metal manufacturer, stamped either 50/50 or 60/40 "Warranted".

B. Flux

1. Paste or acid type as recommended by the metal manufacturer.

C. Bituminous Coating: FS TT-C494.

D. Type 3 Sealant (For concealed sealant joints of thru-wall cap receivers and other areas which require concealed sealant).

1. One part butyl rubber sealant; Pecora BC-158, PTI 707, or Woodmont chem-Calk 300.

E. Flashing Sealants and Adhesives (where applicable)

1. Provide products recommended in writing by the flashing manufacturer, and compatible with all adjacent materials, including components of the air barrier system. Materials containing asbestos are prohibited. Mastics and other asphaltic materials shall not be used where sealant is specified or required.

2.. Where low modulus silicone sealant is indicated provide ASTM C 920, single-component, neutral-curing silicone; Class 100/50, Grade NS, Use NT, Use O.

F. Hinged Gutter Guards

1. Width to match gutter; as manufactured by US Gutter Systems, or approved equal.

G. Splash Blocks

1. Precast sloped concrete splash block pad, 3,500 psi, approximate size 1 foot x 2 feet long.

2.7 FABRICATION

A. Form gutters, rakes, downspouts and elbows as indicated on drawings

B. Fabricate with required connection pieces.

C. Form sections to shape indicated on Drawings, square, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance.

D. Hem exposed edges of metal.

E. Downspouts

1. Materials: Plain copper or lead coated copper.

2. Components (where applicable)

a. Hung Gutter: 20 oz.

b. Downspouts: 16 oz.

c. Conductor Heads: 16 oz.

d. Outlet Tube, offsets and elbows: 16 oz.

e. Continuous cleats: 20 oz.

f. Downspout Support Hanger: 1"x1/16" brass or copper.

g. Wire Strainers: 18 gage copper wire, 1/2" mesh.

3. Fabrication

a. Fabricate gutters, downspouts and fittings to shapes and profiles indicated on Drawings; if details are not indicated, follow applicable

requirements of the Architectural Sheet Metal Manual of SMACNA.

b. Form downspouts in 10'-0" long sections (where applicable).

2.7 INSTALLATION

A. Installing Thru Wall Scupper

1 Where protected membrane roofing is provided, scuppers shall be equipped with grilles with opening size not greater than the size of stone ballast used on the roof.

2. Lock and solder, or rivet and solder all construction joints of the scupper (where applicable).

B. Installation of Downspouts:

1 Join the downspout sections with end joints that telescope at least 1½"

2 Install necessary offsets and elbows.

3 Install a minimum of 2 hangers at each downspout section. Form hangers to keep downspouts 1" away from wall.

4 Fasten downspouts to hangers with sheet metal screws.

5 Secure hangers to masonry and concrete walls with machine bolts in lead shields and to wood walls with screws.

6 Discharge Elbows: Fasten leader shoes to downspouts with a minimum of 3 sheet metal screws.

7 Connection to Underground Drains: Fit the downspout neatly into the drain pipe or boot. Caulk the joint with lead wool and seal with sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.

3.4 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer’s recommendations.

B. Protect installed products until completion of project.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install caulking and sealants.

2. Extent of each type of caulking and sealant is shown or indicated and includes the following:

a. Interior and exterior joints in equipment and construction systems not filled by another material, and that are not required to be open for operation.

b. Exposed-to-view joints of all fire-rated sealants.

c. Joints specified to be re-caulked.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed with or before caulking and sealants.

2. Notify other trades in advance of installation of caulking and sealants to provide other trades with sufficient time for installing their work that must be installed before caulking and sealants.

3. Coordinate final selection of caulking and sealants so that materials are compatible with all caulking and sealant substrates specified.

1.2 REFERENCES

A. American Society of Testing Material (ASTM) Publications:

B. ASTM C510, Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.

1. ASTM C661, Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

2. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.

3. ASTM C794, Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

4. ASTM C920, Specification for Elastomeric Joint Sealants.

5. ASTM C1021, Practice for Laboratories Engaged in Testing Building Sealants.

6. ASTM C1087, Test method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.

7. ASTM C1193, Guide for Use of Joint Sealants.

8. ASTM C1247, Practice for Durability of Sealants Exposed to Continuous Immersion in Liquids.

C. Federal Specifications (FS)

1. FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

2. FS TT-S-00230 Sealing Compound: Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

D. South Coast Air Quality Management District's (SCAQMD).

1. SCAQMD Rule 1168.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Installer:

a. Engage a single installer, approved by product manufacturer, regularly engaged in caulking and sealant installation and with successful experience in applying types of products required, and who employs only tradesmen with specific skill and successful experience in the type of Work required.

2. Testing Laboratory:

a. Furnish services of independent testing laboratory qualified according to ASTM C1021, for conducting testing required.

B. Component Supply and Compatibility:

1. Obtain materials only from manufacturers who will, if required:

a. Furnish at the Site services of a qualified technical representative to advise installer of proper procedures and precautions for using materials.

b. Test caulking and sealants for compatibility with substrates for conformance with FS-TT-S-00227, and recommend remedial procedures as required.

2. Before purchasing each sealant, investigate its compatibility with joint surfaces, joint fillers, and other materials in joint system. Provide products that are fully compatible with actual installation condition, verified by manufacturer's published data or certification, and as shown on approved Shop Drawings and other approved submittals.

3. Product Testing: Provide test results of laboratory pre-construction compatibility and adhesion testing, as specified in Article 3.1 of this Section, by qualified testing laboratory, based on testing of current sealant formulations within a 36-month period preceding the Notice to Proceed for the Work.

4. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920 and, where applicable, to other standard test methods.

5. Test other joint sealants for compliance using specified post-construction field adhesion test.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Schedule of caulking and sealants installation, indication each specific surface where caulking or sealants are to be provided and the material proposed for each application.

2. Product Data:

a. Copies of manufacturer's data sheets including color charts, specifications, recommendations, and installation instructions for each type of sealant, caulking compound, and associated miscellaneous material required. Include manufacturer's published data, indicating that each product complies with the Contract

Documents and is intended for the applications shown or indicated.

b. Product test reports and UL Listed design data sheets

B. Informational Submittals: Submit the following:

1. Certificates:

a. Certify that materials are suitable for intended use and materials meet or exceed requirements of the Contract Documents.

b. Certification from manufacturer that products furnished are appropriate for surfaces and conditions to which they will be applied.

c. Certify that applicator is approved by manufacturer.

2. Field Quality Control Submittals:

a. Results of tests on job mock-ups.

b. Pre-construction and post-construction field test reports.

c. Compatibility and adhesion test reports.

d. Contractor's Field Test Report Logs:

1) Indicate time present at the Site.

2) Include observations and results of field tests, and document compliance with manufacturer's installation instructions and supplemental instructions provided to installers.

3. Pre-installation conference record.

4. Qualifications: Submit qualifications for:

a. Installer.

b. Testing laboratory

C. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data:

a. Recommended inspection intervals.

b. Instructions for repairing and replacing failed sealant joints.

2. Warranty: Submit written warranties as specified in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with the following:

1. Delivery of Products:

a. Deliver products in caulking and sealant manufacturer's original unopened, undamaged containers, indicating compliance with approved Shop Drawings and approved Sample color selections.

b. Include the following information on label:

1) Name of material and Supplier.

2) Formula or Specification Section number, lot number, color and date of manufacture.

3) Mixing instructions, shelf life, and curing time, when applicable.

2. Storage of Products:

a. Do not store or expose materials to temperature above 90 degrees F or store in direct sunlight.

b. Do not use materials that are outdated as indicated by shelf life.

c. Store sealant tape in manner that will not deform tape.

d. In cool or cold weather, store containers for sixteen hours before using in temperature of approximately 75 degrees F.

e. When high temperatures prevail, store mixed sealants in a cool place.

3. Handling:

a. Do not open containers or mix components until necessary preparatory Work and priming are complete.

1.6 JOB CONDITIONS

A. Conform to applicable OSHA and the New York State Building Codes.

B. Environmental Conditions:

1. Do not install caulking and sealants under adverse weather conditions, or

when temperatures are below or above manufacturer's recommended limitations for installation.

2. Proceed with the Work when forecasted weather conditions are favorable for proper cure and development of high-early bond strength.

3. Where joint width is affected by ambient temperature variations, install elastomeric sealants when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.

4. When high temperatures prevail, avoid mixing sealants in direct sunlight.

5. Supplemental heat sources required to maintain both ambient and surface temperatures within the range recommended by manufacturer for material applications are not available at the Site.

6. Provide supplemental heat and energy sources, power, equipment, and operating, maintenance, and temperature monitoring personnel.

7. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas of caulking, sealants, and painting Work, and areas where Owner's personnel or construction personnel may work. Properly locate and vent such heat sources to outdoors so that caulking and sealants and other Work are unaffected by exhaust.

1.7 WARRANTY

A. Provide written warranty, signed by manufacturer and Contractor, agreeing to repair or replace sealants that fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified in approved Shop Drawings and other submittals, as an inherent quality of material for exposure indicated.

1. Provide manufacturer warranty for period of one year from date of Substantial Completion of caulking and sealants Work.

2. Provide installer warranty for period of two years from date of Substantial Completion of caulking and sealants Work.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Provide elastomeric joint sealants for interior and exterior joint applications that

establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. VOC Performance Criteria:

1. VOC content of sealants used shall comply with current VOC content limits of SCAQMD Rule 1168. Sealants used as fillers shall comply with or exceed requirements of BAAQMD Regulation 8, Rule 51.

a. Sealants: 250 g/L.

b. Sealant Primers for Nonporous Substrates: 250 g/L.

c. Sealant Primers for Porous Substrates: 775 g/L.

C. Provide colors selected by Engineer from caulking and sealant manufacturer's standard and custom color charts. "Or equal" manufacturers shall provide same generic products and colors as available from manufacturers specified.

2.2 MATERIALS

A. Exterior and Interior Vertical Joints; Non-submerged:

1. Two-component Polyurethane Sealant:

a. Products and Manufacturers: Provide one of the following:

1) Sikaflex- 2c NS by Sika Corporation.

2) Dymeric 240 FC by Tremco Sealant/Waterproofing Division of RPM International, Inc.

3) Or equal.

b. Polyurethane based, two-component elastomeric sealant complying with:

1) FS TT-S-00227E: Type II (non-sag) Class A and ASTM C920, Type M, Grade NS, Class 25.

2) Adhesion-in-Peel, FS TT-S-00227E and ASTM C794: (Minimum five pounds per linear inch with no adhesion failure): 10 pounds.

3) Hardness (Standard Conditions), ASTM C661: 25 to 35 (Shore A).

4) Stain and color change, FS TT-S-00227E and ASTM C510:

No discoloration or stain.

5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weatherometer.

6) Rheological Vertical Displacement at 120 degrees F, FS TT-S-00227E: No sag.

7) VOC Content: 100 g/L, maximum.

B. Exterior and Interior Horizontal Joints; Non-submerged:

1. Two-component Polyurethane Sealant:

a. Products and Manufacturers: Provide one of the following:

1) Sikaflex- 2c SL by Sika Corporation.

2) THC/900 by Tremco Sealant/Waterproofing Division of RPM International, Inc.

3) Or equal.

b. Polyurethane based, two-component elastomeric, self-leveling sealant complying with the following:

1) FS TT-S-00227E, Type I (self-leveling) Class A. and ASTM C920, Type M, Grade P, Class 25

2) Water Immersion Bond, FS TT-S-00227E: Elongation of 50 percent with no adhesive failure.

3) Hardness (Standard Conditions), ASTM C661: 35 to 45.

4) Stain and Color Change, FS TT-S-00227E and ASTM C510: No discoloration or stain.

5) Accelerated Aging, ASTM C793: No change in sealant characteristics after 250 hours in weather meter.

6) VOC Content: 165 g/L, maximum.

C. Miscellaneous Materials:

1. Joint Cleaner: As recommended by caulking and sealant manufacturer.

2. Joint Primer and Sealer: As recommended for compatibility with caulking and sealant by caulking and sealant manufacturer.

3. Bond Breaker Type: Polyethylene tape or other plastic tape as recommended for compatibility with caulking and sealant by caulking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of caulking and sealant. Provide self-adhesive tape where applicable.

4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with caulking and sealant by caulking and sealant manufacturer. Provide size and shape of rod that will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide highly-compressible backer to minimize possibility of sealant extrusion when joint is compressed.

5. Low-temperature Catalyst: As recommended by caulking and sealant manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and conditions under which caulking, and sealant Work will be performed, and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work and performance of sealants. Do not proceed with caulking and sealant Work until unsatisfactory conditions are corrected.

B. Laboratory Pre-construction 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 ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit at least eight pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For products that fail tests, obtain joint-sealant manufacturer's written instructions for corrective measures including using specially formulated primers.

5. Immersion Testing: ASTM C1247 for potable water and wastewater.

6. Testing will not be required if joint sealant manufacturers submit joint preparation data based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted and mock-up field testing is acceptable.

3.2 PREPARATION

A. Protection: Do not allow caulking and sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or caulking and sealant materials.

B. Joint Surface Preparation:

1. Clean joint surfaces immediately before installing sealant compound. Remove dirt, weakly adhering coatings, moisture and other substances that would interfere with bonds of sealant compound as recommended in sealant manufacturer's written instructions as shown on approved Shop Drawings.

2. If necessary, clean porous materials by grinding, sandblasting, or mechanical abrading. Blow out joints with oil-free compressed air or by vacuumingjoints prior to applying primer or sealant.

3. Roughen joint surfaces on vitreous coated and similar non-porous materials, when sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce a dull sheen.

C. Mixing:

1. Comply with sealant manufacturer's written instructions for mixing multi-component sealants.

2. Thoroughly mix components before use.

3. Add entire contents of activator can to base container. Do not mix partial units.

4. Mix contents for minimum of five minutes or as recommended by sealant manufacturer, until color and consistency are uniform.

3.3 INSTALLATION

A. Install caulking and sealants after adjacent areas have been cleaned and before joint has been cleaned and primed, to ensure caulking and sealant joints will not besoiled. Replace caulking and sealant joints soiled after installation.

B. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or indicated in the Contract Documents, and except where manufacturer's technical representative directs otherwise, only as acceptable to Engineer.

C. Prime or seal joint surfaces as shown on approved Shop Drawings and approved other submittals. Do not allow primer or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to applying sealants.

D. Apply masking tape before installing primer, in continuous strips in alignment with joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.

E. Do not install sealants without backer rods and bond breaker tape.

F. Roll back-up rod stock into joint to avoid lengthwise stretching. Do not twist, braid, puncture, or prime backer rods.

G. Employ only proven installation techniques that will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

H. Install sealants to depths recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of bead.

1. For horizontal joints in sidewalks, pavements, and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.

2. For vertical joints subjected to normal movement and sealed with elastomeric sealants and not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.

I. Remove excess and spillage of compounds promptly as the Work progresses.

J. Cure caulking and sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high-early bond strength, internal cohesive strength, and surface durability.

3.4 EXISTING JOINTS

A. Mechanically remove existing sealant and backer rod.

B. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface.

C. Conduct laboratory pre-construction compatibility and adhesion testing on joint surfaces in accordance with Paragraph 3.1.B of this Section.

D. Allow joint surfaces to dry before installing new sealants.

3.5 FIELD QUALITY CONTROL

A. Post-construction Field Adhesion Testing: Before installing elastomeric sealants, field-test joint sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform ten tests for the first 1,000 feet of joint length for each type of elastomeric sealant and joint substrate.

b. Perform one test for each 1,000 feet of joint length thereafter, and minimum of one test per each floor per elevation.

c. Test Method: Test joint sealants according to Method A, Field-applied Sealant Joint Hand Pull Tab, and Method D, Water Immersion in Appendix X1 of ASTM C1193. For joints with dissimilar substrates, verify adhesion to each substrate separately by extending cut along one side and verifying adhesion to opposite side. Repeat procedure for opposite side.

d. Inspect joints for complete fill, absence of voids, and joint configuration complying with specified requirements. Record results in a log of field adhesion tests.

e. Inspect tested joints and report on whether:

1) Sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

2) Sealants filled the joint cavities and are free of voids.

3) Sealant dimensions and configurations comply with specified requirements.

f. Record test results in a log of field adhesion tests. Include dates when sealants were installed, names of persons who installed

sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

g. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

h. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other requirements will be satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

i. Do not proceed with installation of elastomeric sealants over joint surfaces that have been painted, lacquered, waterproofed, or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

B. Water Leak Testing: Field test for water leaks as follows:

1. Flood the joint exposure with water directed from a 3/4-inch diameter garden hose, without nozzle, held perpendicular to wall face, two feet from joint and connected to water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.

2. Test approximately five percent of total joint system, in locations that are typical of every joint condition, and that can be inspected easily for leakage on opposite face. Conduct test in presence of Engineer, who will determine actual percentage of joints to be tested and actual period of exposure to water from hose, based on extent of observed leakage or lack of observed leakage.

3. Where nature of observed leaks indicates potential of inadequate joint bond strength, Engineer may direct that additional testing be performed at a time when joints are fully cured, and before Substantial Completion.

3.6 ADJUSTING AND CLEANING

A. Where leaks and lack of adhesion are evident, replace sealant.

B. Clean adjacent surfaces of sealant and soiling resulting from the Work. Use solvent or cleaning agent recommended by sealant manufacturer. Leave all finish Work in neat, clean condition.

C. Protect sealants during construction so that they will be without deterioration, soiling, or damage at time of readiness for final payment of the Contract.

3.7 PROTECTION

A. During and after curing period, protect joint sealants 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.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide hollow metal doors and frames as indicated on Drawings and specified herein.

1.2 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:

1. Section 08 71 00, Door Hardware

2. Section 08 90 00, Louvers and Vents.

1.3 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

1. Underwriters' Laboratories, Inc. (UL)

2. American Society for Testing and Materials (ASTM)

3. National Fire Protection Association (NFPA)

4. Steel Door Institute (SDI)

5. Hollow Metal Manufacturers Association (HMMA)

1.4 SUBMITTALS

A. Product Data

Manufacturer's catalog sheets, specifications, and installation instructions.

B. Shop Drawings:

1. Show details of each frame type, elevation and construction for each door type, conditions at openings, location for each door type, location and installation requirements for finish hardware (including cutouts and

reinforcements), details of connections, and anchorage and accessory items.

2. Include a schedule of doors and frames using the same reference numbers for details and openings as those on the Contract Drawings.

3. For sound rated assemblies, provide drawings indicating interface of sound rated doors and frames with adjacent construction. Include details of each frame type, cam hinge (when used), sound seals, door bottom, threshold, and door. Indicate location and installation requirements of door and frame hardware and reinforcements. Indicate glazing materials and details for glazed assemblies.

C. Samples

1. Frames: Corner sample of each type, 18" x 18" with mortises and reinforcements, shop primed.

2. Doors: Corner sample of each type showing construction, 18" x 18", with mortises and reinforcements, shop primed.

3. Security Louver panel, as per Section 08 91 19.

D. Quality Control Submittals

1. Include approval data and acceptance by a New York City Building Department approved testing agency for all fire-rated assemblies.

2. Provide certification glazing meets safety impact requirements of CPSC 16 CFR 1201.

3. Provide certification for oversized assemblies as described in Quality Assurance.

E. Warranties

1. Provide manufacturer/installer warranty.

1.5 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI A250.8 and as herein specified.

B. Fire Rated Assemblies

Wherever fire resistance classification is shown or scheduled for hollow metal doors and frames, provide fire rated units that have been tested as fire door assemblies and comply with National Fire Protection Association (NFPA) Standard No. 80, are tested in accordance with NFPA 252 or UL 10B/UL 10C and

UL 1784 as required by the NYS Building Code and comply with these Specifications. Identify each door and frame with metal UL, or Warnock Hersey labels indicating applicable fire class of the unit. Rivet or weld labels on the hinge edge of door and jamb rabbet of frame.

1. Oversize Assemblies: Whenever fire rated assemblies are larger than size limitations established by NFPA, provide manufacturer's certification that they have been constructed with materials and methods equivalent to requirements for labeled construction.

2. See Door Schedule in the Drawings for Label Requirements (Class) for respective openings.

C. Regulatory Requirements

1. Notwithstanding the requirements for fire-rated assemblies noted above, all fire-rated doors and frames shall be approved for use in New York State

2. Provide evidence of acceptance by an approved testing agency. Provide permanent labels on doors and frames as required by the New York State Building Code. Labels shall be applied at the factory or where fabrication and assembly are performed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames on raised platforms in vertical position with blocking between units to allow air circulation.

B. During delivery, storage and handling, protect doors and frames from water damage.

C. Provide delivery, storage and handling in such manner to prevent damage to products.

1.7 FIELD EXAMINATION

A. At the Site, before door installation, the Owner reserves the right to select at random one or more doors for examination by cutting a portion of such size to reveal the construction of the particular door.

1. If the examination finds that the doors examined do not comply with requirements of the Specifications, all doors shall be removed from the Site and new doors shall be provided. Costs of examination and replacement of rejected doors shall be borne by Contractor.

2. If the examination finds that the doors do comply with the requirements of the Specifications, the cost of the examination and the cost of the replacement of the examined doors will be borne by the Owner.

1.8 GAUGE STANDARDS

A. Gages specified are based on U.S Standard Gauge for hot rolled and cold rolled steel sheets.

B. The allowable tolerances for steel sheet thicknesses shall be in accordance with HMMA Standards.

1.9 WARRANTY

A. Submit warranty signed by manufacturer and installer, agreeing to replace assemblies which fail in materials, performance or workmanship within the specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acme & Dorf Door Corp., Clifton NJ 07011

B. Ceco Door Products Div., Milan, TN 38358

C. Curries Company, Mason City, IA 50401

D. Long Island Fireproof Door, Port Washington, NY 11050

E. Michbi Doors Inc. Brentwood, NY 11717

F. Or Approved Equal.

2.2 MATERIALS

A. Cold-Rolled Steel Sheets

Commercial Quality carbon steel complying with ASTM A1008 and ASTM A568.

B. Metallic-Coated Steel Sheet

Commercial Quality Steel complying with ASTM A653, Type B with minimum G60 (Z180) or A60 metallic coating.

C. Galvannealed Steel Sheets

Carbon steel sheets of commercial quality complying with ASTM A653 Doors and frames shall have A60 zinc-iron coating, mill phosphatized, complying with ASTM A653.

D. Anchors and Supports

Fabricate of gages indicated on and of not less than 16 gage sheet steel, unless otherwise indicated, on the drawings

1. Galvanized Units: Galvanized anchors and supports used with galvanized frames, complying with ASTM A153, Class B.

E. Anchorage Devices, Bolts, and other Fasteners

Manufacturer's standard units unless otherwise indicated on the Drawings.

1. Galvanized Units: Galvanized items used with galvanized frames complying with ASTM A153, Class C or D as applicable.

2.3 FABRICATION

A. Fabricate hollow metal work accurately and assemble neatly to ensure work smooth and free from dents, tool marks, visible waves, warp, buckles and conspicuous joints.

B. Align lines straight and true with arises and angles as sharp as practicable. Miter corners in true alignment and join similar abutting profiles accurately.

C. Assemble all joints to form imperceptible intersections when finished.

D. Form each member, such as jamb and head, from a single piece of metal, unless otherwise shown or approved.

E. Fasten all members together to provide rigid construction in assembled work. Weld all connections except those for removable members such as glazing beads.

F. Weld, dress smooth and flush joints on exposed faces.

G. Clearances

Fabricate doors for their respective frames within the following clearances:

1. Jambs and Head: 3/32" to 1/8".

2. Meeting Edges of Pairs: 1/8" to 3/16".

3. Bottom (no threshold or carpet): 3/8", maximum.

4. Bottom (at threshold or carpet): 1/4", maximum.

H. Work showing defects or blemishes will be rejected and rejected work shall be replaced with satisfactory work.

2.4 DOORS

A. General

1. Provide steel doors of types and styles indicated on drawings or schedules. Comply with ANSI/SDI A250.8 requirements unless more restrictive requirements are specified herein.

2. Design and Thickness: Flush design doors, seamless vertical edges, hollow construction, 1 3/4" thick unless specifically noted otherwise.

3. Sound Deadening (ASTM E90): Minimum Sound Transmission Class (STC) of 30.

4. Door Edges: Bevel lock stile edge of single acting hinged doors 1/8" in 2". Double acting doors shall have rounded edges, approximately 2¼" radius. Meeting stiles of pairs of single acting doors shall be "V" beveled or rounded as detailed on the Drawings or required.

5. Glazing Stops and Beads: Fixed steel stops, formed integral with door unless otherwise approved by the Owner, on the outside of exterior doors and on the secure side of interior doors. Removable steel beads, of tubular steel of gage indicated on the Drawings or solid bar stock, on the other side of doors secured with machine screws. Form corners with butted hairline joints. Coordinate width of rabbet between fixed stop and removable bead and depth of rabbet with type of glass and glazing required.

6. Glazing:

a. Non-rated doors - 1/4” thick minimum laminated glass meeting safety impact requirements of CPSC 16 CFR 1201.

b. Fire-rated doors – Fire Protection rated glazing meeting safety impact requirements of CPSC 16 CFR 1201.

c. Fire-protection-rated glazing in excess of 100 square inches shall be permitted in fire door assemblies when tested as components of the door assemblies and not as glass lights per NYS Building code.

Size and location of vision panels shall be as indicated on the drawings.

B. Interior Doors

1. Fabricate interior doors with 2 outer stretcher-leveled, steel sheets of 12 gage unless indicated otherwise on the Drawings. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces and stile edges, except around glass and louver panels. On mortise face of door, vertical joints shall be welded, filled and ground smooth.

2. Provide surface sheet reinforcement for surface sheet, edge, hardware, stops and other provisions, of size and gage as detailed on Drawings.

3. Provide 14 GA top and bottom channels and closures as detailed on the Drawings.

4. For all toilet room, locker room, mechanical room, food service area doors and other doors indicated on the door schedule, all outer sheets of the door shall be galvannealed and welds shall be coated with zinc rich primer.

C. Louvered Panels for Doors

1. Provide steel louvers for doors where indicated on Drawings and as specified herein. Refer to Section 08 90 00.

2.5 FRAMES

A. General

1. Provide steel frames for doors, and other openings where shown, of size and profile as indicated on Drawings.

2. Construction: Full-welded unit construction, with corners mitered and continuously welded full depth and width of frame, unless otherwise indicated. Knock-down type frames will not be accepted.

a. Fixed Stops: Integral 5/8" stop unless otherwise indicated. Construct jambs and heads from one piece of metal each; rabbeted and flanged as required for the various types of openings, and neatly mitered or interlocked and welded together. Provide channel, angle and bent plate reinforcing as indicated on approved Shop Drawings or otherwise required. Provide reinforcing in the heads of frames where shown or required.

3. Frame Material

a. Interior Frames: 12 gage Galvannealed steel sheet unless indicated otherwise on Drawings.

4. Provide frames for masonry openings with adjustable Underwriter's type masonry anchors to suit conditions of installation, using not less than three (3) at each jamb, in addition to floor anchors.

5. Provide frames with calking stops, filler pieces and trim where indicated on Drawings or required; integrally formed as part of the frame wherever possible. Applied calking stops, filler pieces, and other members as indicated, shall be neatly attached by spot welding. All welds at galvannealed frames shall be painted with zinc-rich primer.

6. Equip sound-proof frames with adjustable door stops and continuous rubber seals. Fill frames solidly with sound-deadening material.

7. At butts, cut back jamb the thickness of one leaf of butt.

8. Drill and tap reinforcement to template.

9. Spot weld 20 gage plaster guard to frame at latch cutouts, if applicable. Paint all welded areas with zinc-rich primer.

10. Provide reinforcement for hardware as indicated on Drawings and as required for proper hardware installation. Refer to Section 08 71 00 - Door Hardware.

11. Provide frames for other openings as indicated on the Drawings.

12. Provide cutouts and reinforcing for security devices as required.

2.6 SHOP PAINTING

A. All doors shall be delivered to the site with a full shop coat. Doors not fully shop coated shall not be accepted.

B. Chemically wash, rinse, and dry exposed and concealed surfaces of fabricated units.

C. Apply one coat of rust-inhibiting primer (Carboline “Carbozinc 11 HS” or approved equal) to all exposed surfaces of ungalvannealed doors and frames. Use the same paint to touch up all welded areas of galvannealed doors and frames. Apply primer per the manufacturer’s recommendations

D. Units shall pass the following tests:

1. Salt Spray Test complying with ASTM B117 for 120 continuous hours.

2. Water fog Test Complying with ASTM D1735 or ASTM D4585 for 240 continuous hours

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

Examine substrate and conditions, under which the frames are to be installed, for defects which will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3. 2 INSTALLATION

A. Install hollow metal doors, frames, and accessories in accordance with the Drawing Details, approved Shop Drawings, and the manufacturer's printed instructions, except as otherwise indicated.

B. Frame Installations

Place frames accurately in position; plumb, align, and brace securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreader bars, leaving surfaces smooth and undamaged.

1. At in-place concrete and in-place masonry construction, place frames and secure in place with anchorage devices. Set anchorage devices opposite each anchor location, in accordance with details on approved Shop Drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

    a. Anchor frames as detailed on the Drawings.

2. Place fire rated frames in accordance with NFPA Standard No. 80.

3. Provide necessary field splices in frames as detailed on approved Shop Drawings, welded and finished to match factory fabrication.

4. Extend jambs to structural floor slab and securely anchor in place.

C. Door Installation

1. Install doors accurately in their respective frames within the clearance specified in Part 2.

2. Place fire rated doors with clearances as specified in NFPA standard No. 80.

D. Drill and tap doors and frames to receive surface applied hardware.

3.3 ADJUSTING

A. Prime Coat Touch-up

Immediately after installation, sand smooth and clean rusted and damaged areas of shop prime coat and apply touch-up of original primer.

B. Final Adjustments

Check and adjust operating finish hardware items prior to final inspection. Leave work in complete and proper operating condition.

3.4 CLEANING

A. Clean doors, frames, and accessories, leaving free of dirt and other foreign material after completion of installation.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 08 36 80

OVERHEAD ROLLING DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install overhead rolling doors.

2. The extent of overhead rolling doors is shown on the Contract Drawings and in schedules.

3. The types of rolling door Work required includes the following:

a. Insulated aluminum overhead rolling door. (unless otherwise indicated on drawings)

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the overhead rolling doors.

2. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

C. Related Sections:

1. Division 26, Electrical.

1.2 QUALITY ASSURANCE

A. Wind Loading Design Criteria: Design and reinforce rolling doors to withstand a wind loading pressure of 30 pounds per square feet.

B. Source Quality Control: Provide overhead rolling doors as complete units produced by a single manufacturer specializing in the production of this type of work, including hardware, accessories, mounting and installation components.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. Aluminum Association (AA) Standards and Finish Designations.

2. ASTM A446, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

3. ASTM A525, General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

4. National Electrical Manufacturers Association (NEMA), Standard KS 1.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Drawings for components and installations as shown or specified.

2. Copies of manufacturer's specifications, roughing-in diagrams, and installation instructions for each type and size of rolling door. Include manufacturer's data, operating instructions and maintenance data. Indicate by transmittal form that installer has received a copy of diagrams and installation instructions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver doors and frames cartoned or crated to provide protection during transit and job storage.

2. Inspect metal work upon delivery for damage. Minor damage may be repaired provided the finish items are equal in all respects to new work and acceptable to the Engineer, otherwise, remove and replace damaged items as directed.

B. Storage of Materials: Store doors and frames at the building site under cover. Place units up off the floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Door Curtain:

1. Door Curtain Slats: Fabricate rolling door curtain of flat interlocking slats designed to withstand the specified wind loading, of continuous length for the

width of the door without splices. Unless otherwise shown or specified, provide slats of the material gauge recommended by the door manufacturer for the size and type of door required, as follows:

a. Aluminum Door Curtain Slats: Provide the following minimum gage materials for all door types: 16 gage Brown and Sharpe. Double faced slats insulated with closed cell polyethylene foam. Provide the following equivalent anodic finish and color after AA Number M34C22 combined pretreatment (caustic etch with satin finish).

1) AA Number A42 with medium bronze.

2. Endlocks: Heavy malleable iron castings, secured to curtain slats with 2 galvanized rivets. Provide locks on alternate curtain slats for curtain alignment and resistance against lateral movement.

3. Windlocks: Heavy malleable iron castings secured to curtain slats with 3 galvanized rivets. Space windlocks approximately 24 inches on center on both edges of curtain.

4. Bottom Bar: Consisting of 2 aluminum angles, each not less than 1-1/2 inches by 1-1/2 inches by 1/8 inch thick.

B. Curtain Jamb Guides:

1. Fabricate curtain jamb guides of Type 316 stainless steel shapes with sufficient depth and strength to retain the curtain against specified wind loading. Build-up units with minimum 3/16-inch thick steel sections complying with ASTM A36. Slot bolt holes for track adjustment.

2. Secure guides to continuous wall angles. Place anchor bolts on exterior wall guides so that they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and a continuous bar for holding windlocks.

C. Weather Seals, Exterior Doors: Provide natural rubber or neoprene rubber weatherstripping for exterior doors. Secure weather seals with continuous metal pressure bars. At door heads, use a 1/8-inch thick continuous sheet secured to the inside of the curatin coil hood. At door jambs, use a 1/8-inch thick continuous strip secured to the exterior side of the jamb guide.

D. Counterbalancing Mechanism:

1. Counterbalance doors by means of an adjustable steel helical torsion spring mounted around a steel shaft and mounted in a spring barrel and connected to

the door curtain with the required barrel rings. Use grease-sealed ball bearings or self-lubricating graphite bearings for all rotating members.

2. Counterbalance Barrel:

   a. Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support the roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03 inch per foot of span under full load.

   b. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance the weight of the curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to the barrel and the shaft.

   c. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold the fixed spring ends and carry the torsional load.

3. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

4. Hood:

   a. Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as a weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

   b. Fabricate hoods of Alloy 3003 aluminum sheet not less than 0.032-inches thick, mill finish.

E. Product and Manufacturer: Provide one of the following:

1. Overhead Door Model 422 Sectional Steel Door, Model 630,631 Fire rated doors

2. Thermal Series as manufactured by Atlas Door Corporation.

3. Thermiser as manufactured by Cornell Iron Works Incorporated.

4. Or approved equal.

2.2 ACCESSORIES

A. Electric Door Operators:

1. General: Furnish electric door operator assembly of the size and capacity recommended and provided by the door manufacturer; complete with electric motor and factory-prewired motor controls, gear reduction unit, solenoid operated brake, clutch, remote control stations, and control devices meeting NEMA 1 requirements.

2. Provide a hand-operated disconnect or a mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation. Mount disconnect and operator so that they are accessible from floor level. Include an interlock device to automatically prevent the motor from operating when emergency operator is engaged.

3. Design operator so that motor may be removed without disturbing the limit-switch adjustment and without affecting the emergency auxiliary operator.

4. Door Operator Type: Provide wall or bracket-mounted door operator units consisting of an electric motor, a worm gear drive from motor to reduction gear box, a chain or worm gear drive from reduction box to a gear wheel mounted on the counterbalance shaft, and a quick-clutch disconnect-release for manual operation. Provide motor, clutch, and drive assembly of horsepower and design as determined by the door manufacturer for the size of door required and as herein specified.

5. Electric Motors:

   a. Provide high-starting torque, reversible, constant duty, Class A insulated electric motors with overload protection.

   b. Provide UL Listed electric operator, size and type as recommended by the manufacturer (1 horsepower motor min.) to move door in either direction, from any position, at not less than 8 inches nor more than 12 inches per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.

   c. Coordinate wiring requirements and current characteristics of motors with the building electrical system; see Division 26 of these Specifications.

   d. Provide open-drip-proof type, unless otherwise shown or specified.

   e. Motors shall be 3 phase, rated for 460-volt operation.

6. Remote Control Station:

   a. Unless otherwise shown, provide momentary-contact, 3-button NEMA 1 control station with push button controls labeled "open," "close" and "stop." Install at location as shown or scheduled.

7. Safety Edge Device: Provide each door with an electric safety switch, extending full width of the door bottom, and located within a U-shaped neoprene or rubber astragal mounted to the bottom door rail. Design the unit to operate such that contact with the switch before fully closing will immediately stop the downward travel and reverse the direction to the fully opened position. Connect to the control circuit through a retracting safety cord. The compressible strip shall also serve as a weatherseal along the bottom of the door.

2.3 SURFACE PREPARATION AND SHOP PAINTING

A. Clean and prime coat ferrous metal surface of equipment in the shop in accordance with the requirements of Section 09 91 13.

B. Coat bearing, gear and similar mechanical, polished and non-ferrous metal surfaces with corrosion prevention compound which shall be maintained during storage and until equipment begins operation.

C. Field painting is under Section 09 91 13.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor and his installer must examine the substrates and conditions under which the rolling door unit is to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 INSTALLATION

A. Install, connect and adjust doors in full accordance with the manufacturer's written instructions, the approved Shop Drawings, and as shown and specified. Refer to paragraph 1.1.B of this Section for the requirements of coordination with others.

B. Install, wire, connect and adjust doors, motors, starters, pushbutton stations, limit and safety switches and all other electrical accessories and connections required in full accordance with the manufacturer's written instructions, the approved Shop Drawings,

and as shown and specified. Refer to paragraph 1.1.B of this Section for the requirements of coordination with others.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation including the work by other trades, test and adjust doors to operate easily, free from warp, twist or distortion. Test the door in presence of Engineer to demonstrate compliance with the Specifications and the manufacturers design criteria.

3.4 ADJUSTMENT AND CLEANING

A. Adjust mechanism so moving parts operate smoothly.

B. Repair damage to rolling doors, and match manufacturer's original finish.

C. Leave work area clean and free of debris.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 08 71 00

FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, material, equipment and incidentals required to provide finish hardware as shown and specified.

2. The extent of finish hardware is shown on the Drawings and in schedules. Finish hardware is defined to include all items known commercially as finish hardware, as required for swing doors, except special types of unique and unmatching hardware specified in the same Section as the door and door frame.

3. The types of finish hardware required include the following and as indicated in the Hardware Schedule on the drawings:

   a. Mortise hinges.

   b. Locksets.

   c. Latchsets.

   d. Door closers.

   e. Stripping and seals.

   f. Thresholds.

   g. Miscellaneous items.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the finish hardware.

C. The contractor shall coordinate the installation of security door hardware specified in these specifications and in the construction drawings, including but not limited to, electric door strikes, locksets, magnetic locks, interchangeable lock cores, and any other related door security hardware, with the District's security system vendor, prior to ordering the hardware, to ensure the final installation is fully coordinated and integrated with the security system vendor's work.

D. Related Work Specified Elsewhere:

1. Section 08 11 13, Metal Doors and Frames.

1.2 QUALITY ASSURANCE

A. Supplier Qualifications: The finish hardware supplier shall have in their employ a member of the American Society of Architectural Hardware Consultants who shall be responsible for the complete finish hardware contract.

B. Design Criteria:

1. Match the existing lock and latch set manufacturer and keying system, where applicable.

2. Where the finish, shape, size, or function of a member receiving finish hardware is such as to prevent the use of, or make unsuitable the types specified, furnish similar types having as nearly as practicable the same operation.

3. If finish hardware for any location is not specified, provide finish hardware equal in design and quality to adjacent finish hardware for comparable openings.

4. Furnish finish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security, and similar requirements, as necessary for proper installation and function.

5. Contractor shall bring to Engineer's attention any item of finish hardware which cannot be installed or will not function properly.

6. Unless otherwise specified, comply with the National Builders Hardware Association, "Recommended Locations for Builders Hardware."

7. For fire rated openings, provide hardware complying with NFPA 80. Provide hardware which has UL approval for the intended use.

C. Requirements of Regulatory Agencies:

1. Codes: Comply with the applicable requirements of the New York State Uniform Fire Prevention and Building Code for the types of finish hardware specified.

D. Source Quality Control: To the greatest extent possible, obtain each type of finish hardware from only one manufacturer. Locksets, latch sets, and cylinders must originate from the same manufacturer.

E. Reference Standards: Comply with the applicable provisions and recommendations of the following except where otherwise shown or specified:

1. FS TT-S-001657, Sealing Compound - Single Component, Butyl Rubber Based, Solvent Release Type.

2. National Builders Hardware Association, Recommended Locations for Builders Hardware.

3. NFPA Standard No. 80, fire doors and windows.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following, in accordance with Division 1:

1. Copies of manufacturer's data for each item of finish hardware. Include whatever information may be necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.

2. Copies of the finish hardware schedule, in the manner and format specified, complying with the actual construction progress schedule requirements (for each draft). Include a separate key schedule, showing clearly how the Owner's final instructions on keying of locks have been fulfilled. Finish hardware schedules are intended for coordination of the Work. Review and acceptance by the Engineer does not relieve the Contractor of their exclusive responsibility to fulfill the requirements as shown and specified.

3. Based on the finish hardware requirements specified, organize the final finish hardware schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other work (such as hollow metal frames) which may be critical in the Project construction schedule. Furnish final draft of schedule after samples, manufacturer's data sheets, coordination with Shop Drawings for other work, delivery schedules and similar information have been completed and accepted.

B. Samples: Prior to submittal of the final hardware schedule and prior to delivery of hardware, submit one sample of each exposed hardware unit, finished as required, and tagged with full description for coordination with the schedule. Sample will be reviewed by Engineer for design, color, and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.

C. Owner's Replacement Stock: Samples submitted which are approved by the Engineer will be forwarded to the Owner for use as replacement stock.

D. Prepare a keying schedule in consultation with the Owner.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver finish hardware sufficiently in advance of its setting for proper inspection.

2. Pack each piece of finish hardware separately, complete with screws, keying, instructions, and templates, tagged to correspond with the approved finish hardware schedule.

B. Storage of Materials:

1. Provide secure lock-up for finish hardware stored at the site, but not yet installed.

2. Store finish hardware in manufacturers' original packages.

C. Handling of Materials: Control the handling and installation of finish hardware items which are not immediately replaceable, so that the completion of the Work will not be delayed by finish hardware losses, both before and after installation.

1.5 JOB CONDITIONS

A. Scheduling: Deliver individually packaged finish hardware items at the proper time to the proper locations for installation.

B. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory prepared for the installation of hardware work to confirm that adequate provisions are made for the proper installation of hardware.

C. Coordination: Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installations in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.

1.6 SUBSTITUTIONS

A. Do not make substitutions after Engineer's approval of final finish hardware schedule.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General:

1. Hand of Door: The Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of finish hardware for proper installation and operation of the door swing as shown.

2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates).

3. Base Metals: Produce finish hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition, temper and hardness. Do not substitute materials or forming methods for those specified.

4. Fasteners: Manufacture finish hardware to conform to published templates, generally prepared for machine screw installation. Do not provide finish hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

5. Furnish screws for installation, with each finish hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

6. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.

7. No exposed fasteners on hardware units shall be visible when doors are closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other Work under any condition, except where it is not possible to adequately reinforce the Work and use machine screws or concealed fasteners of another standard type to satisfactorily avoid the use of through bolts.

8. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, removal and replacement of finish hardware.

9. Field Checks: Make periodic checks during installation of finish hardware to ascertain the correctness of the installation. After completion of the work, certify in writing that all items of finish hardware have been installed, adjusted and are functioning in accordance with Specification requirements.

10. Hardware shall be as indicated on Hardware Schedule on the drawings.

B. Mortise Hinge:

1. Templates and Screws: Provide only template-produced units.

2. Base Metal: Except as otherwise specified, fabricate hinges from stainless steel and finish to match the latch and lock set. Set 1: Dark Bronze finish. Set 2: Chrome finish

3. Number of Hinges: Except as otherwise specified, provide two hinges on each door leaf of less than 60 inches and an additional hinge for each 30 inches or fraction thereof.

4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:

   a. Interior Doors: Maximum 48 inches wide: 5-inch heavy weight (0.190 inch)

   b. Exterior Doors: Maximum 48 inches wide: 6-inch heavy weight (0.203 inch).

   c. All hinges for 1 3/4 inch thick doors shall be 4 1/2 inches wide in the open position. For other door thicknesses hinges shall be of width to permit unobstructed swing of the door.

5. Types of Hinges: Provide full-mortise type, ball-bearing hinges swaged for mortise applications, inner leaf beveled, square cornered, unless manufacturer's recommendations indicate that half-mortise, half-surface, full-surface or other type should be used for the frame and door type or condition.

6. Hinge Pins: Except as otherwise specified, provide hinge pins as follows:

   a. Pins: Non-rising stainless steel.

   b. Exterior Doors: Non-removable non-rising pins, modern type.

   c. Tips: Flat button and matching plug with no horizontal lines, finished to match leaves.

7. Product and Manufacturer: Provide one of the following:

a. T4A3386 A5111 Stainless HVY by ASSA ABLOY

b. Or approved equal.

C. Continuous Hinges

1. Hager Concealed 780-112HD AL, Heavy Duty

2. Or approved equal.

D. Non-Keyed Passage Latchset Interior Mortise Style: Provide interior doors with latch sets as specified below:

1. Strikes: Provide manufacturer's standard wrought steel box strike, for each location and use shown. Provide curved lip strikes, unless otherwise recommended by manufacturer, finished to match latch set trim.

2. Material: Provide all stainless steel chassis, including heavy-duty cylindrical case, latch case and front.

3. Backsets: Provide backset of 2 3/4 inches.

4. Modify specified locks and latches to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.

5. Finish: U.S. 32D satin on stainless steel. (or as noted otherwise)

6. Operation: The latch bolt shall be retracted by knob from either side at all times.

7. All locksets and latchsets, etc., shall be of one manufacturer's products. Design shall be Schlage Mortise style or approved equal.

8. Product and Manufacturers: Provide one of the following:

a. Schlage L Series 1000, Function 9010.

b. Or approved equal.

E. Storeroom Locksets, Exterior Mortise Style, Keyed: Provide exterior doors with lock and latch sets as specified below:

1. Material: Provide all stainless steel chassis, including heavy-duty cylindrical case, latch case and front.

2. Backsets: Provide backset of 2 3/4 inches.

3. Modify specified locks and latches to comply with UL, Building Materials Director, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.

4. Finish: U.S. 32D satin on stainless steel.

5. Operation: The latch bolt shall be retracted by key outside or knob inside. The auxiliary latch shall deadlock the latch bolt when the door is closed. The inside knob shall be always free for immediate exit.

6. All locksets, etc., shall be of one manufacturer's products. Design shall be Schlage keyed mortise style, or approved equal.

7. Product and Manufacturers: Provide one of the following:

   a. Best Locks, 7 pin core to match facility standards.

   b. No substitutions.

F. Privacy Lockset: Provide doors with lock and latch sets as specified below:

1. Material: Provide all stainless steel chassis, including heavy-duty cylindrical case, latch case and front.

2. Backsets: Provide backset of 2 3/4 inches.

3. Modify specified locks and latches to comply with UL, Building Materials Director, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.

4. Finish: U.S. 32D satin on stainless steel.

5. Operation: Latch bolt operated by lever from either side except when outside lever is locked by inside turn or button. Operating inside lever, closing door or operating outside emergency release unlocks outside lever. Storeroom locks are used when the outside lever should be locked at all times.

6. All locksets, etc., shall be of one manufacturer's products. Design shall be Schlage keyed mortise style, or approved equal.

G. Product and Manufacturers: Provide one of the following:

1. Schlage L Series, Function 9040

2. Or approved equal.

H. Cylinders and Keying System:

1. Multiple-Building System: Match Owner's master.

2. Equip all locks with manufacturer's standard 6-pin tumbler cylinder and provide Owner with four keys to match each tumbler assembly. All locksets shall be provided with either identical or independently keyed tumbler assemblies, as directed by Owner.

3. Each key shall be stamped "Do Not Duplicate."

I. Electrified Breakaway Lever(where applicable):

1. Manufacturer: Von Duprin E996L, or approved equal.

J. Electrified Concealed Electrical Power Transfer:

1. Powder coat finish, predrilled hole in base.

2. Concealed Electrical Power Transfer shall be provided, unless otherwise specified, as follows:

a. Securitron CEPT-10. Description - US32D, concealed, 10 wire, ANSI/UL10C listed,3 HR rated
b. Or approved equal.

K. Exit Device:

1. Rim exit device with night latch lock (for locking)

2. Certified to ANSI/BHMA A156.3 2014, Grade 1

3. Manufacturer: Best Exit Device; match facility standard.

4. No substitutions.

L. Electric Strike for Exit Device:

1. For single doors: Von Duprin 6111

2. For pair doors: Von Duprin 6121

3. Or approved equal.

M. Door Closers:

1. Provide all doors both active and inactive, with door closers.

2. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use. Use adjustable size closers, changeable from size 2 through 6 and reversible for right or left hand doors.

3. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.

4. Provide hold open feature for all doors except fire rated doors.

5. Provide long arm to allow door to swing 180 degrees where possible.

6. Provide individual regulating valves for closing and latching speeds, and separate adjustable backcheck valve, preset at 75 degrees.

7. Provide corner bracket on all exterior doors. Select arms to clear weatherstripping and overhead stops.

8. Material: Heavy Duty Cast iron.

9. Finish: Aluminum Enamel

10. Product and Manufacturer: All closing devices and accessories are to be one manufacturer's products. Provide one of the following:

    a. 281 Series Door Closers by Sargent Division of Walter Kidde and Company, Incorporated.

    b. 1600SS Series Door Closers by Norton Security Products, Division of Scovill Industries.

    c. Or approved equal.

N. Overhead Stops: (where applicable or otherwise indicated on plans)

1. Provide heavy duty (30 pounds per square foot) overhead holder and stop with hold open feature on all exterior doors, both leafs. Comply with UL and NFPA requirements.

2. Materials: Provide the following materials:

    a. Shock Absorber Spring: Brass.

    b. All Other Parts: Extruded bronze.

3. Coordinate placement of overhead holder and stop with arm and bracket selection for door closers, for non-interference.

4. Product and Manufacturer: Provide one of the following:

    a. GJ 79HD Series Heavy Duty Overhead Door Holder by Glynn Johnson Corporation.

    b. Or approved equal.

O. Wall and Floor Stops:

1. All doors shall have stops. Provide floor stops only where conditions preclude the use of wall stops.

2. Materials: Stainless steel or brass chassis with gray rubber tip.

3. Finish: US 32D Satin or US26D Satin, as scheduled.

4. Provide concealed stainless steel fasteners as required by the substrate.

5. Coordinate height of dome type floor mounted door stops with threshold condition and undercut of door.

6. Product and Manufacturer: Provide one of the following (except where otherwise specified):

    a. 408B wall-mounted concave series and 436 floor-mounted dome type series by Ives Company.

    b. WB60MX wall-mounted concave series and l3X floor-mounted dome type series by Glynn Johnson Division of The Citation Companies.

    c. Or approved equal.

P. Coordinators:

1. Provide coordinator device on all pairs of doors requiring automatic flush bolts. Comply with UL, List of Inspected Fired Protection Equipment and Material, and NFPA No. 80 requirements.

2. Provide manufacturer’s standard carry bar and strike on all pairs of doors equipped with coordinator.

3. Materials: Bronze.

4. Finish: Polished bronze.

5. Product and Manufacturer: Provide one of the following:

    a. CORG series by Ives Company.

b. COR 65 by Glynn-Johnson.

c. Or approved equal.

Q. Stripping and Seals: (where applicable)

1. Provide perimeter weather stripping at all exterior doors and doors in walls forming hazardous spaces and as specified.

2. Continuity of Stripping: Except as otherwise specified, it is required that the stripping at each opening be continuous and without unnecessary interruptions at door corners and hardware.

3. Replaceable Seal Strips: It is required that the resilient or flexible seal strip of every unit be easily replaceable and readily available from stocks maintained by the manufacturer.

4. Provide bumper type weather stripping at jambs and head, including a resilient insert and metal retainer strip, surface applied, of the following metal, finish and resilient bumper material:

   a. Housing: Extruded aluminum with medium bronze anodized finish; 0.062-inch minimum thickness of main walls and flanges.

   b. Seals: Silicone or vinyl.

5. Product and Manufacturer: Provide one of the following:

   a. No. 293AV by Pemko Manufacturing Company.

   b. No. 129VDUR by Reese Enterprises, Inc.

   c. Or approved equal.

6. Provide automatic drop-seal sound-stripping door-bottom unit of manufacturer's standard design, with operating seal bar of the following material, retained in an extruded metal bar, and capable of operating to close a 3/4-inch gap (from door bottom to floor or threshold). House mechanism and operating bar in the following metal housing, for mounting on doors as follows:

   a. Housing: Extruded aluminum, 0.062-inch thick, with medium bronze anodized finish on exposed surfaces.

   b. Seal: Closed-cell sponge neoprene.

c. Mounting: Surface-mounted, except as otherwise indicated. Mount on stop-face of doors, except mount on hinge-face of swing-in exterior doors.

7. Product and Manufacturer: Provide one of the following:

a. No. 430DS by Pemko Manufacturing Company.

b. No. 330DUR by Reese Enterprises, Inc.

c. Or equal.

R. Astragals:

1. Provide metal and neoprene astragal for exposed flat head screw mounting on both leaves of all pairs of doors.

2. Provide astragal of extruded aluminum, medium bronze anodized finish and black neoprene.

3. Product and Manufacturer: Provide one of the following:

a. No. 375DR Series by Pemko Manufacturing Company.

b. No. 93DUR by Reese Enterprises, Incorporated (with additional screws through neoprene).

c. Or approved equal.

S. Flush Bolts: (where applicable)

1. Provide flush bolts on the inactive leaf of all pairs of doors, at the top and bottom of door.

2. Materials: Provide the following materials:

a. Flush Bolt Levers: Aluminum.

b. Flush Bolt Plate: Aluminum.

c. Flush Bolt Guide and Strike: Wrought brass.

d. Flush Bolt Rods: 1/2-inch round rods, bronze, 12-inch minimum length.

e. Bolt Head: Brass.

3. All flush bolts furnished for labeled doors shall have UL approval.

4. Provide extension flush bolts with 3/4-inch throws and with top bolt not over 6 feet above finished floor. Provide bottom flush bolt 12 inches long.

5. Product and Manufacturer: Provide one of the following:

   a. 458 Flush Bolt by Ives Company.

   b. Or approved equal.

T. Automatic Door Bottom (where applicable): Surface mounted and adjustable.

1. Zero 365AA

2. Or approved equal.

U. Thresholds:

1. Provide thresholds on all exterior doors and doors in walls forming hazardous spaces and as specified on Door Schedule.

2. Metal: Extruded aluminum, smooth commercial finish.

3. Surface Pattern: Grooved tread, manufacturer's standard.

4. Provide countersunk aluminum screws and expansion shields.

5. Width: 5 inches wide and full width of opening.

6. Construction: Single piece complying with manufacturer's recommendations.

7. Profile: Provide manufacturer's standard flat unit with low profile. For doors equipped with panic hardware, including floor bolts, provide profile with stop bar of proper size and shape to function as the strike plate for the floor bolts.

8. Thickness: 1/2-inch maximum.

9. Product and Manufacturer: Provide one of the following:

   a. 655,8655 and 655A-V3 by Pemko Manufacturing Company, for low profile.

   b. S406A and S105 by Reese Enterprises, Incorporated.

   c. Or approved equal.

V. Latch Guard:

1. Rockwood 320-32D.

2. Or approved equal.

W. Silencers:

1. Provide silencers for all non-fire rated door frames. Refer to Section 08100, for number required.

2. Product and Manufacturer: provide one of the following:

a. No. 3446 by Sargent and Company.

b. No. 33 by Russwin, Division of Emhart Corporation.

c. Or approved equal.

X. Sealants: Provide butyl rubber sealant complying with FS TT-S-001657 for use with thresholds.

Y. Kick Plates: 8” high, stainless steel, on push side, unless otherwise indicated on drawings:

1. Ives 8400

2. Or approved equal.

Z. Rain Drip:

1. Provide rain drip for all exterior doors not protected by an overhang.

2. Metal: Extruded medium bronze anodized aluminum.

3. Provide projecting leg of 2 1/2 inches.

4. Product and Manufacturer: Provide one of the following:

a. R201 DUR by Reese Enterprises Incorporated.

b. 142 by Zero Weatherstripping Company, Incorporated.

c. Or equal.

AA. Push Plates and Pull Bars:

1. All push plates shall be 14-gauge by 3-inch by l2-inch wrought plates with beveled edges.

2. All pull bars shall be 3/8-inch by 1 1/4-inch by 6 3/8-inch bar, fastened to a back plate that matches the push plate.

2.2 HARDWARE FINISHES

A. Provide matching finishes for finish hardware units at each door or opening, to the greatest extent possible. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of finish hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set for color and texture. All hardware and hinges shall have a US32D finish unless otherwise noted. All surface closers shall have a USP finish unless otherwise noted.

PART 3 - EXECUTION

3.1 GENERAL

A. Finish Hardware Schedule

Provide hardware for each door, each pair of doors, and each set of doors, in compliance with "Hardware Set Numbers" indicated in Door Schedule on Drawings, and as specified herein.

Manufacturer's names and product designations for hardware types are listed for the purpose of establishing minimum requirements. Provide the product specified or comparable product of other manufacturers listed in Art. 2.01 for each hardware type.

All door frames located in smoke partitions and fire-rated partitions shall be provided with continuous smoke seals at jambs and head, whether or not listed in Hardware Sets below. Manufacturer/model: Pemko S44D; McKinney S44D.

B. Approval: As soon as practical after award of General Construction Contract and before a hardware schedule is prepared, and before any hardware is ordered or delivered to the project, the Contractor shall submit to the Engineer for their written approval, copies of sample list, listing each of the different items of builders' finishing hardware and catalog cuts of each item proposed.

3.2 KEYING

A. Contractor shall provide Temporary Construction Cores in all locks for use during and throughout Construction.

B. Contractor shall confirm with Owner the type of core used in other buildings in the facility so project's cores match.

C. At Substantial Completion Engineer and Owner shall advise of Final Keying Arrangement.

3.3 INSPECTION

A. Contractor shall examine the substrate to receive finish hardware and ascertain the conditions under which the Work will be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the finish hardware Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.4 PREPARATION

A. Templates: Within 10 days after receipt of the approved hardware schedule, the hardware supplier shall furnish finish hardware templates to each fabricator of doors, frames, and other work to be factory prepared for the installation of finish hardware. Upon request, check the Shop Drawings of such other work, to confirm that adequate provisions are made for the proper installation of the finish hardware.

3.5 INSTALLATION

A. Installation of all hardware shall be in a manner which will eliminate cracks on surfaces which could allow the growth of biological life by providing crevices and joints which can collect moisture and germs.

B. Mount finish hardware units at heights recommended in, "Recommended Locations for Builders' Hardware," by National Builders Hardware Association, except as otherwise specified or required to comply with governing regulations.

C. Install each finish hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install finish hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

G. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel which will not corrode in contact with the threshold metal.

H. Set thresholds in a bead of butyl rubber sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant.

3.6 ADJUSTMENT AND CLEANING

A. Adjust and check each operating item of finish hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.

B. Final Adjustment: Where finish hardware installation is made more than 1 month prior to acceptance or occupancy of a space or area, return to the Work during the week prior to acceptance or occupancy, and make a final check and adjustment of all finish hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of finish hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.

C. Instruct Owner’s personnel in proper adjustment and maintenance of finish hardware during the final adjustment of finish hardware.

D. Finish hardware which is blemished or defective will be rejected even though it was set in place before defects were discovered. Remove and replace with new finish hardware. Repair all resultant damage to other work.

E. Continued Maintenance Service: Approximately 6 months after the acceptance of finish hardware in each area, the Contractor, accompanied by the representative of the latch and lock manufacturer, shall return to the Project and re-adjust every item of hardware to restore proper function of doors and finish hardware. Consult with and instruct Owner’s personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace finish hardware items which have deteriorated or failed due to faulty design, materials or installation of finish hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the finish hardware.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 08 90 00

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

D. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following 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 normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of

components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

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

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

2. Show mullion profiles and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of metal finish required.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

2. AWS D1.3, "Structural Welding Code - Sheet Steel."

3. AWS D1.6, "Structural Welding Code - Stainless Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.

2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.

4. For fastening stainless steel, use 300 series stainless-steel fasteners.

5. For color-finished louvers, use fasteners with heads that match color of louvers.

C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 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. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Horizontal Mullions: Provide horizontal mullions at joints where indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. 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.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. 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. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.

2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semirecessed mullions at corners.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. 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.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant, Sight-proof, Louver (Exterior louvers only):

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. Air Balance Inc.; a Mestek company.

b. Air Flow Company, Inc.

c. Airolite Company, LLC (The).

d. All-Lite Architectural Products.

e. American Warming and Ventilating, Inc.; a Mestek company.

f. Arrow United Industries; a division of Mestek, Inc.

g. Construction Specialties, Inc.

h. Greenheck Fan Corporation.

i. Industrial Louvers, Inc.

j. NCA Manufacturing, Inc.

k. Nystrom Building Products.

l. Reliable Products, Inc.

m. Ruskin Company; Tomkins PLC.

n. United Enertech Corp.

2. Louver Depth: 5 inches.

3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.

4. Louver Performance Ratings:

a. Free Area: Not less than 5.0 sq. ft. for 48-inch- wide by 48-inch-high louver.

b. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area exhaust /intake velocity.

c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 300 fpm.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.

2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.

3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Director's Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 09 29 00

CEMENT BOARD

PART 1 - GENERAL

1.1 CEMENTITIOUS BACKER PANEL

A. Basis of Design: Subject to compliance with project requirements, the design is based on the following: Cement Board".

B. Classification: Cementitious Backer Units: ANSI A118.9, ASTM A108.11 and ASTM C 1325 provide with manufacturer's standard edges.

1. Thickness: As indicated on the drawings.

2. Board Length: 8 feet.

3. Board Width: 48 inches.

4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

C. Minimum bending radius: 6 feet.

D. Fastener Requirements: Provide fasteners of size and type indicated that comply with requirements specified in this Section for material and application.

1. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Sheathing SF steel drill screws with corrosion-resistant coating.

2. Wood Screws: Sheathing WF screws with corrosion-resistant coating.

3. Nails: 11-gauge hot-dipped galvanized roofing nails.

E. Installation Requirements:

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.

2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

F. Standard:

1. Cement board exceeds ANSI standards for cementitious backer units (CBU). See ANSI A118.9 for test methods and specifications for CBU and ANSI A108.11 for interior installation of CBU. Exceeds industry standards as an

exterior substrate for exterior finishes. Exceeds ASTM C1325 standards for non asbestos fiber-mat reinforced cementitious backer units.

1.2 COMPOSITION AND MATERIALS

A. Cement board is formed in a continuous process of aggregated portland cement slurry with polymer-coated, glass-fiber mesh completely encompassing edges, back and front surfaces. The edges are formed smooth. The ends are square cut.

1.3 DEILIVERY AND STORAGE OF MATERIALS

A. All materials should be delivered and stored in their original unopened package and stored in an enclosed shelter providing protection from damage and exposure to the elements. Even though the stability and durability of cement board is unaffected by the elements, moisture and temperature variations may have an effect on the bonding effectiveness of basecoats and adhesives. Store all cement board panels flat.

1.4 ENVIRONMENTAL CONDITIONS

A. In cold weather and during cement board panel and tile installation, temperatures within the building shall be maintained within the range of 40 to 100°F. Adequate ventilation shall be provided to carry off excess moisture.

1.5 INTERIOR APPLICATIONS

A. The building shall be enclosed and the HVAC system operating so that wood framing shall reach the moisture content it will reach in service. Do not install board when the board is wet.

1.6 EXTERIOR APPLICATIONS

A. In exterior applications, cement board should not be left uncovered for a period of time exceeding 90 days. Discoloration or staining may occur due to exposure to the elements which will not affect performance of the panel. Finishes, leveling/skim coats and basecoats should not be applied to cement board panel that is wet or frozen or that contains frost. After application, and for at least 24 hours, finishes, leveling/skim coats and basecoats should be effectively protected from rain and excessive moisture. In cold weather and during finish applications, cement board panel, skim or basecoat, mortar, finish material and air temperature must be at least 40°F and must remain at this temperature or higher for at least 24 hours after application. Hot and dry weather may affect working time of leveling/skim or basecoat and finish materials. Under rapid drying conditions, dampening or light fogging of board, leveling/ skim or basecoat surface may be required to improve workability.

1.7 PANEL MICROCRACKING

A. Cement board is formulated to develop fine microcracking (also called as multiple cracking) in the panel. The microcracking process helps to evenly relieve the stored strain energy in the product due to handling and installation, external loads and/or panel restrained movement. The presence of microcracks in the panel should not be considered a product defect.

B. Installation:

1. Install cement board with ends and edges closely abutted, but not forced together. Stagger end joints in successive courses.

2. For flooring applications over a wood-based substrate, laminate cement board to subfloor using Type 1 organic adhesive or latex-modified thin-set mortar suitable for bonding cement board. Fasten to subfloor with 1-1/4" Tile Backer Screws for wood framing (or equivalent) or 1-1/2" hot-dipped galvanized roofing nails spaced 8" o.c. in both directions with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges. Drive nails and screws so that bottoms of heads are flush with panel surface to ensure firm panel contact with subfloor. Do not overdrive fasteners. Prefill joints with tile-setting mortar or adhesive and then immediately embed Tile Backer Tape and level joints.

3. For wall application, fasten cement board panels to framing with specified fasteners. Drive fasteners into field of panels first, working toward ends and edges. Hold panels in firm contact with framing while driving fasteners. Space fasteners maximum 8" o.c. for walls, 6" o.c. for ceilings, with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges. Drive nails and screws so bottoms of heads are flush with panel surface to ensure firm panel contact with framing. Do not overdrive fasteners. Approved fasteners include: tile backer screws for steel framing (or equivalent), 1-1/4" and 1-5/8" for 14- to 20-gauge steel framing; tile backer screws for wood framing (or equivalent), 1-1/4", 1-5/8" and 2-1/4" for wood framing. Nails (1-1/2" hot dipped galvanized roofing nails). Prefill joints with tile-setting mortar or adhesive and then immediately embed tile backer tape and level joints.

4. Cement board should be cut to size with a knife and straight edge. A power saw should be used only if it is equipped with a dust-collection device. Installer should wear NIOSH/MSHA approved dust mask.

5. If waterproofing is desired, use *Waterproofing Membrane* (CB595) for product information.

C. Limitation:

1. Designed for positive or negative uniform loads up to 60 psf. For complete information on the use of panels in exterior systems, consult uniform load table on Page 4 for applicable positive or negative uniform loads on wall systems.

2. Wall applications: Maximum stud spacing: 16" o.c. (24" o.c. for cavity shaft wall assembly). Framing shall be designed (based on stud properties alone) not to exceed L/360 deflection for tile and thin brick, L/240 for direct-applied exterior finish systems. Maximum fastener spacing: 8" o.c. for wood and steel framing; 6" o.c. for ceiling applications.

3. Floor applications: Maximum joist spacing 24" o.c. The subfloor system should be designed with a minimum deflection limit of L/360 for the span. Some finish materials may require a more rigid subassembly (such as large format tile and natural stone products). In these cases, follow the manufacturer's minimum requirements. The subfloor should be APA Span-Rated Plywood or OSB with an Exposure 1 classification or better with tongue and groove or back blocked at the unsupported edges.

4. In exterior applications, cement board should not be left uncovered for a period of time exceeding 90 days. Discoloration or staining may occur due to exposure to the elements which will not affect performance of the panel.

5. Brittle coatings, such as epoxy coatings, are not recommended for use with cement board. Cement board is intended for use with tile, thin brick and exterior stucco coatings only.

6. Maximum dead load for ceiling system is 7.5 psf.

7. Steel framing must be 20-gauge equivalent or heavier.

8. Do not use drywall screws or drywall nails. Do not use drywall joint tape.

9. Do not use 1/4" cement board for wall or ceiling applications.

10. Do not use cement board with vinyl flooring.

11. Cement board is not designed for use as a structural panel.

12. Maximum installed weight of the finish system should not exceed 15 psf.

13. Cement board panels should not be used in areas where they are exposed to temperatures that exceed 200°F.

14. In locations close to salt water or other challenging environments, design professionals should consider the use of stainless steel fasteners.

15. Do not use lightweight setting-type joint compounds or ready-mix joint compounds directly over cement board.

D. Technical Data

Property	**Unit of Measure**	**ASTM Test Method**	**5/8" USG Cement Board**	**½" Cement Board**	**¼" Cement Board**
Flexural strength	PSI	C947	>480	>750	>1000
Indentation strength	PSI	D2394	>1250	>1250	>1250
Shear bond strength	PSI	ANSI A118.4	>50	>50	>50
Water absorption	% by wt.24hrs	C473	15	15	15
Nail-pull resistance	Lb. (0.375" head diameter, wet or dry)	C473	>90	>90	-
Weight	PSF	C473	3	2.4	<1.9
Freeze / thaw resistance	Procedure B, number of cycles with no deterioration	C666	100	100	100
Mold resistance	-	G21 D3273	Rating O, No growth 10/10	Rating O, No growth 10/10	Rating O, No growth 10/10
No combustibility	Pass/Fail	E136	Pass	Pass	Pass
Surface-burning characteristics	Flame/smoke	E84	0/0	0/0	0/0
Thermal	"R" / k value	C518	.49/1.27	0.39/1.27	-
Standard method for evaluating ceramic floor tile installation systems	Passes cycles 1-6	C627	Light commercial	Light commercial	Light commercial

Property	Unit of Measure	ASTM Test Method	5/8" USG Cement Board	½" Cement Board	¼" Cement Board
Minimum bending radius	Ft. (requires special framing details available upon request)	-	6	6	-

1.8 UNIFORM LOAD—1/2" USG DUROCK® BRAND CEMENT BOARD

Stud Spacing	Fastener Spacing	Design Wind Load (1/240)	Design Wind Load (1/360)
12" O.C	8" O.C	45 psf	45 psf
	6" O.C	60 psf	60 psf
16" O.C	8" O.C	33 psf	30 psf
	6" O.C	45 psf	30 psf
24" O.C (for shaft wall assemblies only)	8" O.C	13 psf	9 psf
	6" O.C	13 psf	9 psf

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Definitions: Resinous flooring includes penetrating, moisture tolerant, two-component epoxy primer, a high performance, three-component, chemical resistant mortar consisting of bisphenol F epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments, a two-component, chemical resistant bisphenol F epoxy coating and a selected, graded, large grit silica aggregate.

B. Related Work

1. Section 03 30 00, Concrete Cast in Place

2. Section 07 92 00, Joint Sealers

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.

B. Samples: Submit, for verification purposes, 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.

1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and

complexity; Stonhard or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

B. Pre-Installation Conference

1. General contractor shall arrange a meeting not less than thirty days prior to starting work.

2. Attendance

a. General Contractor

b. Architect/Owner's Representative

c. Manufacturer/Installer's Representative

C. ISO 9001: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9001 registered quality system.

1.5 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.

B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85°F/16 and 30°C.

1.6 PROJECT CONDITIONS

A. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

B. Utilities, including electric, water, heat (air temperature between 60 and 85°F/16 and 30°C) and finished lighting to be supplied by General Contractor.

C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor.

1.7 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation.

PART 2 - PRODUCTS

2.1 COLORS

A. Colors: As selected by Architect from manufacturer's standard colors. (or as indicated on drawing)

2.2 EPOXY FLOORING

A. Stonclad HT coated with Stonkote HT4 with Texture #3 as manufactured by Stonhard, Inc., Maple Shade, NJ, (800) 257-7953 is a nominal 1/4"/6mm thick system comprised of a penetrating, moisture tolerant, two-component epoxy primer, a high performance, three-component, chemical resistant mortar consisting of bisphenol F epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments, a two-component, 100% solids, chemical resistant, bisphenol F epoxy coating and a selected, graded, large grit silica aggregate.

1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

Compressive Strength..... 11,500 psi
(ASTM C-579)

Tensile Strength..... 2,200 psi
(ASTM C-307)

Flexural Strength ..... 5,000 psi
(ASTM C-580)

Hardness 87-90
(ASTM D-2240/Shore D Durometer)
Impact Resistance .....> 160 in. lbs.
(ASTM D-4226)

Abrasion Resistance .....0.08 gm max. weight loss
(ASTM D-4060, Taber
Abrader CS-17 wheel)

Coefficient of Friction 0.80
(ASTM D-2047/Neoprene-Dry)

Flexural Modulus of Elasticity .....1.7 x 10^6 psi
(ASTM C-580)

Flammability.....Self Extinguishing
(ASTM D-635) Extent of burning 0.25 inches max.

Thermal Coefficient of
Linear Expansion.....2.0 x 10^{-5} in/in°C
(ASTM C-531)

Water Absorption 0.2%
(ASTM C-413)

Heat Resistance Limitation.....200°F/93°C
(for continuous exposure) 250°F/122°C
(for intermittent spills)

Cure Rate allow .....8 hours for foot traffic
(at 77°F/25°C) 24 hours for normal operations

2.3 JOINT SEALANT MATERIALS

A. Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Substrate: Concrete preparation shall be by mechanical means and include use of a scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.2 APPLICATION

A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates.

Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.

C. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using stainless steel finishing trowels.

D. Coating/Texture: Remove any surface imperfections by lightly abrading and vacuuming the floor surface. Mix coating according to manufacturer's recommended procedures. Squeegee apply and backroll coating with strict adherence to manufacturer's installation procedures and coverage rates. Broadcast silica aggregate into freshly rolled coating. Allow coating to cure and apply a second layer of coating according to manufacturer's recommended procedures.

3.3 FIELD QUALITY CONTROL

A. The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.

B. The Owner will engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.

D. If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The General Contractor shall furnish all labor, materials, equipment and incidentals required to provide painting as shown and specified.

2. The extent of painting work may be determined by referring to the Contract Drawings, site inspections, other specification sections and as described in this Section.

3. The Work includes the painting and finishing of all exposed new interior and exterior surfaces including, but not limited to, the following:

   a. All structural and framing members.

   b. Miscellaneous metals, pipe sleeves and pipe hangers.

   c. All new exposed piping, fittings, valves and insulation in new and/or existing building(s) as shown on the Contract Drawings and directed by Owner or Engineer.

   d. All new equipment and associated piping.

   e. Exposed wood and rough carpentry

   f. Doors and frames.

   g. Seal coating building floor and new exposed concrete.

   h. Interior surfaces of masonry and brick walls.

   i. Interior walls and ceilings of new structures.

   j. Interior Gypsum and Cement Board Surfaces.

   k. All work specified to be painted as directed by Owner or Engineer, whether or not specifically listed herein.

4. Surface preparation, priming and coats of paint specified are in addition to shop priming and surface treatment specified under this and other sections of the Work.

5. The term "paint" as used herein means all coating system materials, which includes pretreatment, primers, emulsions, enamels, stains, varnishes, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

6. The exposed surfaces of all work shall be painted, whether or not colors are designated in any schedule, except where the natural finish of the material is specifically noted as a surface not to be painted. Unless otherwise noted, the term "exposed" as used herein means all items not covered with concrete. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.

7. All exposed structural members appurtenances, as indicated by the contract drawings and the specifications, which are customarily painted, shall be painted with not less than one shop coat and two field coats, or one prime coat and two finish coats of the appropriate paint.

8. Structural and miscellaneous metals covered with concrete, shall only receive a coating compatible with the covering material.

9. Piping and equipment identification for all new piping and equipment.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be field painted in this Section.

2. Coordinate the painting of areas that are inaccessible once equipment has been installed.

3. Provide finish coats which are compatible with the prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Contractor shall be responsible for the compatibility of all shop primed and field painted items. Furnish information on the characteristics of the finish materials proposed for use to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Engineer in writing of anticipated problems using the coating systems as specified with substrates primed by others.

4. Manufacturers of equipment to receive finish coating in the shop shall submit color charts with shop drawings for color selection by the Owner.

C. Related Work Specified Elsewhere:

1. Section 07 92 00, Sealants.

2. Equipment markers in appropriate equipment section.

D. Painting Not Included: The following categories of Work are not included as part of the field-applied finish Work or are included in other Sections of these Specifications or in other contracts.

1. Shop Priming: Unless otherwise specified, shop priming of structural metal, miscellaneous metal fabrications, other metal items and such fabricated components as shop-fabricated or factory-built heating and ventilating, instrumentation and electrical equipment or accessories shall conform to applicable requirements of Section 09900 but is included under the appropriate Sections of the Specifications.

2. Prefinished Items: Unless otherwise shown or specified, do not include painting when factory finishing such as baked-on enamel, baked-on phenolic resin, porcelain, polyvinyl fluoride or other similar finish is specified for such items as, but not limited to, finished mechanical and electrical equipment such as conduits, fans, ductwork, light fixtures and distribution cabinets, aluminum doors and other equipment. Contractor shall be required to touch-up factory finished items with paint supplied by the item manufacturer. Contractor shall field paint damaged prefinished items as directed by the Engineer.

3. Metal surfaces of aluminum, stainless steel, chromium plate, bronze, copper, and similar finished materials will not require finish painting, unless otherwise shown or specified.

4. Operating Parts and Labels:

a. Moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, motor and fan shafts do not require finish painting unless otherwise shown or specified.

b. Do not paint over any code-required labels, such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

c. Remove all paint, coating or splatter inadvertently placed on these surfaces.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide products manufactured by one of the following:

1. Tnemec Company, Incorporated.

2. Sherwin Williams

3. Or equal.

B. Applicator Qualifications:

1. Submit the name and experience record of the painting applicator. Include a list of utility or industrial installations painted, responsible officials, architects, or engineers concerned with the project and the approximate contract price.

2. Painting applicators whose submissions indicate that they have not had the experience required to perform the Work will not be approved.

C. Source Quality Control: Obtain all materials from the same manufacturer unless otherwise approved. Obtain materials only from manufacturers who will:

1. Provide the services of a qualified manufacturer's representative at the project site at the commencement of Work to advise on materials, installation and finishing techniques.

2. Certify long-term compatibility of all coatings with all substrates, both new and existing.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. ANSI/NSF Standard 61.

2. ANSI A13.1, Scheme for the Identification of Piping Systems.

3. OSHA 1910.144, Safety Color Code for Marking Physical Hazards.

4. AMPP volume 2, Systems and Specifications, Surface Preparation Guide and Paint Application Specifications.

5. Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers Engineers (Ten States Standards), Recommended Standards for Water Works - Latest edition, Painting of Water Works Piping for Public Water Supplies.

E. Manufacturer's Guarantee:

1. The identification signs and nameplates shall be guaranteed in writing by the manufacturer against color fading, chipping, corroding or any other manufacturing defects for a period of ten (10) years.

F. Concrete Floor Mock-Up:

1. Prior to application of concrete floor coating, but after Engineer's approval of floor coating system, the Contractor shall coat a section of the new concrete floor using the approved aggregate and coating specified for final work. Mock-up shall be provided at the site in a location approved by the Engineer. The mock-up shall be of full coating thickness and approximately 5 feet long by 5 feet wide unless otherwise shown. The mock-up shall indicate the proposed range of texture and workmanship to be expected in the completed work. The Contractor shall obtain Engineer's and Owner's acceptance of coating qualities of the mock-up before start of concrete floor coating work. Retain and protect mock-up floor area during construction as a standard for judging completed floor coating work. Do not alter, move or destroy mock-up until given written permission by Engineer. Concrete floor coatings that do not meet the approved mock-up coating area shall be removed and recoated as required by the Engineer.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. Paint samples for Engineer's review of color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Provide a listing of the material and application for each coat of each finish sample.

2. Piping and Equipment Identification:

a. Submit to the Engineer for approval each type of tag proposed and the manufacturer's standard color chart and letter styles. Tags shall have stamped on them the information shown on the valve schedules.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's technical information, including paint label analysis and application instructions for each material proposed for use.

2. Copies of Contractor's proposed protection procedures in each area of the Work.

3. List each material and cross-reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.

4. Copies of manufacturer's complete color charts for each coating system.

5. Maintenance Manual: Upon completion of the Work, furnish copies of a detailed maintenance manual including the following information:

   a. Product name and number.

   b. Name, address and telephone number of manufacturer and local distributor.

   c. Detailed procedures for routine maintenance and cleaning.

   d. Detailed procedures for light repairs such as dents, scratches and staining.

6. Pipe Markers: Copies of manufacturer's technical brochure, including color chart and list of standard markers.

C. Certificates: Submit for approval the following:

1. Certificates stating that materials meet or exceed Specification requirements.

2. Certificate stating that all coatings are compatible with substrate specified, and factory or field applied prime coats.

3. Safety Data Sheets (SDS), for all applicable products. Applicable products include, but are not limited to adhesives, sealants, carpets, paints and coatings applied on the interior of the building. SDS shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an SDS does not include a product's VOC content, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the SDS to indicate the VOC content).

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information.

1. Name or title of material.

2. Manufacturer's stock number and date of manufacture.

3. Manufacturer's name.

4. Contents by volume, for major pigment and vehicle constituents.

5. Batch Numbers

6. Thinning instructions where recommended.

7. Application instructions.

8. Color name and number.

B. Storage of Materials:

1. Store only acceptable project materials on project site.

2. Store in a suitable location approved by the Paint Manufacturer and accepted by the Owner. Keep area clean and accessible.

3. Restrict storage to paint materials and related equipment.

4. Comply with health and fire regulations including the Occupational Safety and Health Act of 1970.

C. Handling:

1. All waste and paint rags shall be kept in tightly covered metal containers and the contents shall be safely disposed of at the end of each working day in accordance with all applicable federal, state and local laws and regulations.

2. A sufficient number of approved type fire extinguishers shall be provided adjacent to the storage area.

1.5 JOB CONDITIONS

A. Existing Conditions:

1. Before painting is started in any area, it shall be broom cleaned and excessive dust shall be removed, and damp surfaces shall be dried.

2. Some existing surfaces may exhibit failing coatings, i.e. peeling, chipped and/or cracked. Paint shall be removed to provide clean adhered surface.

3. After painting operations begin in a given area, broom cleaning will not be allowed; cleaning shall then be done only with commercial vacuum cleaning equipment.

B. Environmental Requirements:

1. Apply water base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 55°F and 90°F unless otherwise permitted by the paint manufacturer's printed instructions.

2. Apply other paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 65°F and 95°F, unless otherwise permitted by the paint manufacturer's printed instructions.

3. Do not apply paint in snow, rain, fog, or mist or when the relative humidity exceeds 85 percent or to damp or wet surfaces, unless otherwise permitted by the paint manufacturer's printed instructions.

4. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

5. Adequate illumination and ventilation shall be provided in all areas where painting operations are in progress.

6. Install piping markers only after all painting and finish Work has been completed.

C. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

D. Manufacturer's Field Service: A qualified representative of the manufacturer shall be available to instruct the painters on any special requirements or techniques for the application of the paints, coatings, etc., at no additional cost to the Owner. Prior to starting any painting, the Contractor shall supply, for use by the Engineer, two wet film thickness gauges and one digital dry film thickness gauge.

PART 2 - PRODUCTS

2.1 MATERIAL QUALITY

A. Provide the best grade of the various types of coatings suitable for use in water supply and water treatment plants and as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Provide primers produced by the same manufacturer as the finish coats. Use only thinners recommended by the paint manufacturer, and use only to recommended limits.

C. Provide paints, and pipe markers of durable and washable quality. Use materials which will withstand normal washing as required to remove grease, oil, chemicals, etc., without showing discoloration, loss of gloss, staining, or other damage.

2.2 SUBSTITUTIONS

A. No substitutions shall be considered that decrease the film thickness, the number of coats, the surface preparation or the generic type of coating specified. Approved manufacturers must furnish the same color selection as the manufacturers specified, including accent colors in all coating systems.

B. No substitutions of paint containing volatile organic compounds (VOCs) shall be considered where paint is specified which does not contain VOCs.

2.3 COLORS AND FINISHES

A. Surface treatments, and finishes, are specified under "Painting Systems" below. All substrates scheduled under "Painting Systems" shall be painted whether or not shown on the Contract Drawings, or in Schedules, unless an item is specifically scheduled as not requiring the painting system scheduled below.

B. Color Selection:

1. Many different colors shall be selected for the Project, in addition to color coding of all piping.

2. The Owner reserves the right to select nonstandard colors for all paint systems specified within the ability of the manufacturer to produce such nonstandard colors. Selection of nonstandard colors shall not be cause for the Contractor rejecting Owner's color selections and the Contractor shall supply such colors at no additional expense to the Owner.

C. After approval of submittals and prior to beginning Work, the Engineer will furnish color schedules for surfaces to be painted listed in the painting systems below.

D. Color Coding: In general, and unless otherwise specified, all color coding of piping, and equipment shall comply with applicable standards of ANSI A13.1, OSHA 1910.144 and the Ten States Standards, Recommended Standards for Water Works, Current Edition.

E. Color Pigments: Pure, nonfading, applicable types to suit the substrates and service indicated.

1. Lead: Lead content shall not exceed amount permitted by federal, state and local government laws and regulations.

F. All painting systems specified are based on brush application except as noted or specified. Other mechanical techniques shall be submitted to the Engineer for approval before these application techniques may be reflected in any paint schedules submitted by the Contractor. Submit proof of acceptability of technique proposed by the paint manufacturer selected.

2.4 PAINTING SYSTEMS

A. Interior CMU walls (unless otherwise specified): Sealer shall be applied with 3/8"-3/4" nap lambswool or solvent resistant cover and not sprayed.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. KOP-COAT:

1) Primer: Epoxy Block Filler - 1 coat, 10.0 dry mils per coat.

2) Finish: Hi-Gard - 2 coats, 3.0-4.0 dry mils per coat. Second coat on floors to provide a skid resistant finish.

b. Tnemec:

1) Primer: Series 130 Envirofill - 1 coat, 10.0 dry mils.

2) Finish: Series V69 H.B. Epoxoline - 2 coats, 3.0-4.0 dry mils per coat. Second coat on floors to provide a skid resistant finish.

c. Sherwin Williams:

1) Primer: Pro Industrial HD Block Filler – 1 coat, 8-10 mils dft.

2) Finish: Macropoxy 646 FC Epoxy – 2 coats, 3-5 mils dft per coat. Second coat on floors to provide a skid resistant finish.

d. Or approved equal.

B. Factory Primed Structural Steel Members; interior non-Submerged:

1. Surface Preparation: Remove chalk, loose paint, grease, oil, rust, scale, all foreign matter, as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

   a. Tnemec:

      1) Shop Holding Primer: Building Manufacturer's choice

      2) Field Primer or field touchup over holding primer: Tnemec Series 115 - 1 coat, 2.0-4.0 dry mils per coat.

      3) Finish: Tnemec Series 1029, 2 coats, 2.0-3.0 dry mils per coat.

   b. Sherwin Williams:

      1) Field touch up Primer: Pro Industrial ProCryl Universal Primer – 1 coat, 2-3.5 mils dft.

      2) Finish: Shercryl HPA, 2 coats, 2-3 dry mils per coat.

   c. Or approved equal

C. Ferrous Metals and all Ferrous Piping; Interior Nonsubmerged:

1. Surface Preparation: Blast Cleaning as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

   a. Tnemec:

      1) Shop Primer: Series V69 H.B. Epoxoline - 1 coat, 3.0-5.0 dry mils per coat.

      2) Field Primer or Field Touch-up: Series V69 H.B. Epoxoline - 1 coat, 3.0-5.0 dry mils per coat.

      3) Finish: Series V69 H.B. Epoxoline - 2 coats, 3.0-5.0 dry mils per coat.

   b. Sherwin Williams:

      1) Shop Primer: Macropoxy 646 FC Epoxy - 1 coat, 3.0-5.0 dry mils per coat.

2) Field Primer or Field Touch-up: Macropoxy 646 FC Epoxy - 1 coat, 3.0 – 5.0 dry mils per coat.

3) Finish: Macropoxy 646 FC Epoxy, 2 coats, 3.0 – 5.0 dry mils per coat.

c. Or approved equal.

D. Ferrous, Nonferrous Metals, and Galvanized Metals; Exterior Nonsubmerged:

1. Surface Preparation:

a. Ferrous Metals: Blast Cleaning as specified in Section 3.2.

b. Galvanized and Nonferrous Metal: Cleaning as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Primer:

a) Ferrous Metals: Series V69 H.B. Epoxoline - 1 coat, 3.0-5.0 dry mils per coat.

b) Nonferrous and Galvanized: None.

2) Intermediate: Series V69 H.B. Epoxoline - 1 coat, 4.0-5.0 dry mils.

3) Finish: Series 1095 Endura-Shield Aliphatic Acrylic Polyurethane - 1 coat, 2.0-3.0 dry mils.

b. Sherwin Williams:

1) Shop Primer: Macropoxy 646 FC Epoxy - 1 coat, 3.0-5.0 dry mils per coat.

2) Field Primer or Field Touch-up: Macropoxy 646 FC Epoxy - 1 coat, 3.0-5.0 dry mils per coat.

3) Finish: High Solids Polyurethane 250, 1 coat, 3.0-4.0 dry mils per coat.

E. Galvanized Metal and Nonferrous Metals; Interior, Nonsubmerged:

1. Surface Preparation: Cleaning, as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Primer: Series V69 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils.

2) Finish: Series V69 H.B. Epoxoline - 1 coat, 2.5-3.5 dry mils.

b. Sherwin Williams:

1) Primer: Macropoxy 646 FC Epoxy- 1 coat, 2.0-4.0 dry mils per coat.

2) Finish: Macropoxy 646 FC Epoxy, 1 coat, 2.0-4.0 dry mils per coat.

c. Or approved equal.

F. Submerged or Intermittently Submerged Ferrous Metals; Interior and Exterior.

1. Surface Preparation: Cleaning, as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Primer/Finish: Series 22 - 1 coat, 24.0-30.0 dry mils per coat.

b. Sherwin Williams

1) Primer/Finish: Sherplate PW Epoxy – 1 coat, 25.0-35.0 dry mils per coat.

c. Or approved equal.

G. All Aluminum in contact with Dissimilar Materials:

1. Surface Preparation: Remove all foreign matter. SSPC-SP1, solvent cleaned.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Series V69 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat.

b. Sherwin Williams:

1) Macropoxy 646 FC Epoxy - 2 coats, 2.0 - 4.0 dry mils per coat.

c. Or approved equal.

H. Ferrous Metals, Buried Exterior:

1. Surface Preparation: SSPC-SP 10, Near-White Blast, as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Shop Primer: Series V69 H.B. Epoxoline - 1 coat, 3.0-5.0 dry mils per coat.

2) Field Primer or Field Touchup: Surface preparation as specified.

3) Finish: Series 46H-413 H.B. Tneme-Tar - 2 coats, 8.0-10.0 dry mils per coat.

b. Sherwin Williams:

1) Shop Primer: Macropoxy 240 - 1 coat, 3.0-5.0 dry mils per coat.

2) Finish: TarGuard Coal Tar Epoxy, 2 coats, 8.0 - 10.0 dry mils per coat.

c. Or approved equal.

I. New and existing Interior Concrete Floors and equipment pads: Sealer shall be applied with 3/8”-3/4” nap lambswool or solvent resistant cover and not sprayed.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.

2. Product and Manufacturer:

a. GP 3477 Epoxy Water Emulsion Primer/Sealer by the Sherwin Williams Company (two coats).

b. L&M Sealhard by Laticrete International.

c. Or approved equal.

J. New Interior Concrete Floors: Paint shall be applied with a brush or roller and not sprayed.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Primer: Series V69 H.B. Epoxoline – 2 coats, 3.0-4.0 dry mils per coat.

2) Finish: Series V69 H.B. Epoxoline - 2 coats, 3.0-4.0 dry mils per coat.

b. Sherwin Williams:

1) Primer: Macropoxy 646 FC Epoxy – 1 coat, 3.0-5.0 dry mils per coat.

2) Finish: Macropoxy 646 FC Epoxy - 2 coats, 3.0-5.0 dry mils per coat.

c. Or approved equal.

K. New Interior Concrete Block and Masonry Walls and Trim: Paint shall be applied with a brush or roller and not sprayed.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Tnemec:

1) Primer: Series 130 EnviroFill Block Filler - 1 coat, 10.0 dry mils.

2) Finish: Series V69 H.B. Epoxoline - 2 coats, 3.0-5.0 dry mils per coat.

b. Sherwin Williams:

1) Primer: Pro Industrial Heavy Duty Block Filler - 2 coats, 8.0 – 10.0 dry mils per coat.

2) Finish: Macropoxy 646 FC Epoxy - 2 coats, 3.0-5.0 dry mils per coat.

c. Or approved equal.

L. New Exterior Masonry Clear Coating:

1. Surface Preparation: Remove Mortar and efflorescence as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Hydrozo Clear Double 7 by Hydrozo Coatings Company (2 coats).

b. Thompson's Water Seal by E.A. Thompson Company (2 coats).

c. Conflex 7% Siloxane CF31T0007, by Sherwin Williams (1 Flood coat)

d. Or approved equal.

M. New Cement Wallboard, Exposed Finish Carpentry, Interior:

1. Surface Preparation:

a. Remove all foreign matter.

b. Fill voids created by securement devices with joint compound to achieve smooth surface.

c. Apply joint tape and joint compound to all lateral joints and at perimeter of ceilings.

d. Sand joint compound with fine grit, open coated sandpaper to provide a smooth, flat surface. If additional joint finishing is required to provide a smooth, flat surface, the same joint compound or a ready mix spackling compound should be used.

e. Remove dust by wiping with clean rags.

2. Product and Manufacturer: Provide the following:

a. Tnemec:

1) Primer: Series 151-1051 Elasto-Grip FC - 1 coat, 1.0-2.0 dry mils per coat.

2) Finish: Series 113 or 114 H.B. Tneme Tufcoat - 2 coats minimum, 4.0-5.0 total dry film thickness.

b. Sherwin Williams:

1) Primer: ProMar 200 Zero VOC Primer – 1 coat, 1.0 – 2.0 dry mils per coat.

2) Finish: Pro Industrial Water Based Catalyzed Epoxy – 2 coats, 3.0 – 4.0 dry mils per coat.

c. Or approved equal.

2.5 PIPING AND EQUIPMENT IDENTIFICATION

A. Identification Signs:

1. Lettering of Titles:

a. Letter size shall be as indicated in the following table:

Outside Diameter of Pipe or Covering	Size of Legend
3/4-in to 1-1/2-in	1/2-in
1-1/2-in to 2-in	3/4-in
2-1/2-in to 6-in	1-1/2-in
8-in to 10-in	2-1/2-in
Over 10-in	3-in

b. Letter type shall be Gothic Capital, upper case. Arrow shall match letter type and size. Colors of lettering and backgrounds shall match colors listed below.

2. Sign Materials:

a. Signs and arrows shall be pressure sensitive vinyl tape with pressure sensitive vinyl tape banding. Banding in humid areas, as determined by the Engineer shall be stainless steel.

b. Product and Manufacturer: Provide one of the following:

1) Opti-Code Special Markers by Seton Name Plate Corporation.

2) Custom Self-sticking Marker System by W.H. Brady Company.

3) Or approved equal.

3. Titles for Equipment:

a. Titles shall be provided on all equipment using 1-inch high letters same style and materials as specified above. Where more than one piece of the equipment item to be titled exists, the items shall be numbered consecutively as indicated on the mechanical drawings or as directed by the Engineer. Titles shall be composed in more than one line if required and justified on the left hand side as follows (for example):

PUMP NO. "X"

4. Metal Tags: For valves and pipelines smaller than 3/4-inch in diameter, securely fasten metal tags, 2-1/2-inch by 1/2-inch, of 17 Birmingham Stubs Gauge Brass with lettering etched and filled with enamel. Tags shall be approved by the Engineer.

B. Additional Signs and Nameplates:

1. In addition to the legends specified herein the Engineer may order the Contractor to furnish and install additional identification signs, arrows and nameplates at no additional cost to the Owner. Such additional signs may be requested near completion of the Work and shall be limited to no more than 10 signs for each of the types specified. The legends and color combinations for additional signs shall conform to the requirements specified herein.

C. Legend for Valve Tags:

1. The Contractor shall be responsible for furnishing and installing tags for all valves required for their own work. Contractor shall submit to the Engineer a valve schedule containing all valves required for their work. The schedule shall contain for each valve, the location, type, a number, words to identify the valve's function, type of operator and the normal operating position. The information contained in the valve schedules shall be coded on the tags in a system provided by the Engineer. Each valve shall be coded and identified by the Engineer utilizing a combination of up to twelve letters and numbers.

D. Colors:

1. Standard Colors: Pipe line signs, equipment nameplates and finish coats of paint for pipe lines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety colors in accordance with ANSI Z53.1 color specifications for safety colors and other basic colors as hereinafter specified.

TABLE OF STANDARD COLORS

Color	**Designation**
White	Safety
Yellow	Safety
Orange	Safety
Red	Safety
Black	Safety
Blue	Safety
Green	Safety
Gray	ANSI No. 61
Brown	*
Light Green	**
Charcoal	***
Olive Green	****
Aqua	$
Light Brown	$$
Dark Blue	$$$

* The color "Brown" for paints shall be equivalent to Tnemec Terra Cotta 07RD.

** The color "Light Green" for paints shall be equivalent to Tnemec Aztec Grass 52GN.

*** The color "Charcoal" for paints shall be equivalent to Tnemec Deep Space GR34.

**** The color "Olive" for paints shall be equivalent to Tnemec Balsam 91GN.

$ The color "Aqua" for paints shall be equivalent to Tnemec Aqua Sky 10GN.

$$ The color "Light Brown" for paints shall be equivalent to Tnemec Desert Sands 04BR.

$$$ The color "Dark Blue" for paints shall be equivalent to Tnemec Old Glory Blue 78BL.

2. Color of Pipe Lines:

a. All pipe lines and equipment shall be painted in conformity with the requirements of this section and the paint schedules contained on the Drawings. The color of the final coats of paint shall be color coded.

b. General Color Code: Unless otherwise specified, the following color code should be used:

Pipe Line	**Color**
Finished (potable) Water Piping	Blue
Raw Water Piping	Olive Green
Well/Booster Blowoff	Olive Green
PTAS Influent	Olive Green
PTAS Effluent / Booster Pump Influent	Olive Green
GAC Influent	Aqua
GAC Effluent	Aqua
GAC Blowoff	Light Brown
Backwash Waste	Light Brown
Clearwell Overflow	Aqua
Lube Water	Blue
Generator Engine Exhaust	Orange
Generator Fill and Vent	Red
Vent Pipes	Gray
Electrical Conduit	Gray
Natural Gas	Red
Carbon Fill	Gray
Carbon Suction	Gray
Pressure Relief	Gray
Air Release	Gray
Vent	Gray
Roof Drains	Black
Chlorine (gas and solution)	Yellow
Caustic	Yellow with Green Band

Vents and drains shall be in the same color combination as the contents of equipment vented and drained.

c. The color of the final coats shall match as closely as possible without custom blending, the color tabulated under Background for the

specific pipe line service as given in the General Color Code tabulated previously.

d. Where aluminum or stainless steel is specified for pipe, duct work or insulated jackets the exterior shall not be painted unless otherwise directed by the Engineer or Owner.

e. Flanges, flexible couplings, valves and fittings shall be painted with the specified color code.

E. Spare Parts and Accessories:

1. Each contractor shall furnish the following spare parts and accessories:

a. For every 20 pipe identification signs installed:

1) One complete mounting assembly.

b. For every 20 nameplates installed:

1) One complete nameplate mounting assembly.

c. For every 20 valve identification tags:

1) One stainless steel cable and splice.

2. All spare parts and accessories shall be suitably boxed and marked for storage and reordering.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor and their applicator shall examine the areas and conditions under which painting Work is to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 SURFACE PREPARATION

A. General:

1. Perform all preparation and cleaning procedures as specified herein and in strict accordance with the paint manufacturer's instructions for each particular substrate and atmospheric condition.

2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

4. No interior painting shall be started until the structure has been enclosed, ventilated and thoroughly dried out, as approved by the Engineer. Apply materials under adequate illumination and ventilation. Special fans shall be provided when natural ventilation is insufficient and if required, face masks shall be provided for the painters. Written consent of the Engineer will be required before building fans may be used. Maintain temperature of rooms at 65°F minimum where varnish, lacquer or enamel is being applied and at 50°F minimum during other painting and finishing. No exterior painting shall be started in rainy, snowy, damp or frosty weather, or until surfaces are thoroughly dry. Exterior painting shall be done only when air temperature is 40°F or above and only in dry weather. Allow exterior paints and finishes to dry at least 48 hours between coats. Allow interior paints to dry at least 24 hours between coats or as otherwise indicated by the manufacturer. Allow enamels, lacquers and varnishes to dry at least forty-eight hours between coats. Remove dust well before succeeding coat is applied. Allow additional drying time if conditions warrant to assure that all coats are perfectly dry before applying succeeding coats. Remove or protect during painting all finish hardware, accessories, fixtures and similar items installed prior to painting and not required to be painted. If removed, carefully replace and adjust on completion of painting. All work shall be performed by experienced and competent painters in conformance with the requirements of the Specifications.

5. All surfaces which were not shop painted or which were improperly shop painted, and all abraded or rusted shop painted surfaces, which are to be painted, as determined by the Engineer, shall be prepared as specified below.

B. Ferrous Metals:

1. Clean ferrous surfaces including structural steel and miscellaneous metal to be shop primed, of all oil, grease, dirt, mill scale and other foreign matter by near-white blast cleaning complying with AMPP/SSPC-10.

2. Clean submerged ferrous surfaces including structural steel and miscellaneous metal to be shop primed, of all oil, grease, dirt, mill scale and other foreign matter by white blasting complying with AMPP/SSPC-SP 5.

3. Clean non-submerged, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by near-white blast cleaning, complying with AMPP/SSPC-SP 10.

4. Clean submerged ferrous surfaces that have not been shop-coated or that, in the opinion of the Engineer, have been improperly shop coated, of all oil, grease, dirt, mill scale and other foreign matter by white blasting complying with AMPP/SSPC-SP 5.

5. Treat bare and blasted or pickled clean metal with metal treatment wash coat, prior to priming only if recommended by the paint manufacturer.

6. Touch-up shop-applied prime coats which have damaged or bare areas, with primer recommended by the coating manufacturer after commercial blasting complying with SSPC-SP 6.

7. Ferrous metals with existing coatings shall be prepared as specified in Section 3.2(E).

C. Nonferrous Metals Surfaces: Clean nonferrous surfaces in accordance with the coating system manufacturer's instructions for the type of service, metal substrate, and application required.

D. Galvanized Surfaces:

1. Render free from oil and surface contaminants with a nonpetroleum based solvent, recommended by the coating manufacturer, complying with AMPP/SSPC-SP 1.

2. Do not use chromate treatments on galvanized surfaces to be painted. Remove all chromate treatments by sanding or by other techniques as recommended by the paint manufacturer at no additional cost to the Owner.

E. Ferrous Surfaces with Existing Coatings:

1. General: All grease, oil heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.

2. Abrasive Blast Cleaning: The Contractor shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to AMPP/SSPC-SP7, Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

3. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings the Contractor shall apply intermediate coatings per the paint manufacturer's recommendation for the specified coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

4. Unknown Coatings: Coatings of unknown composition shall be completely removed prior to application of new coatings.

F. Concrete surfaces:

1. Prepare concrete surfaces in accordance with AMPP/NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 3 or greater surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

3.3 MATERIALS PREPARATION

A. General:

1. Mix and prepare painting materials in strict accordance with the manufacturer's directions.

2. Do not mix coating materials produced by different manufacturers, unless otherwise permitted by the manufacturer's instructions.

3. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

4. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.

3.4 APPLICATION

A. General:

1. Apply paint by brush or roller. Other mechanical application techniques such as air spray, or airless spray in accordance with the manufacturer's directions and recommendations of Paint Application Specifications No. 1 in SSPC Vol. 2 (or equivalent AMPP standard0, where applicable shall be used only as approved by the Engineer. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.

2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.

3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. This is of particular importance regarding intense primary accent colors. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

4. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise specified.

5. Install rubber gaskets to prevent contact between dissimilar metals. Paint aluminum parts in contact with dissimilar materials as specified with appropriate primer.

6. Use of thinners at any time shall have approval of the Engineer, Owner, and paint manufacturers.

7. Omit field primer on metal surfaces which have been shop primed; touch-up paint shop prime coats only when approved by Engineer.

B. Heating, Ventilating and Electrical Work:

1. Ventilating items to be painted include, but are not limited to, the following:

a. Hangers and supports.

b. Motors, mechanical equipment and supports.

c. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:

a. Switchgear, panels, junction boxes, motor control centers, motors and accessories.

C. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, and provide total dry film thickness as specified. Apply extra coat if required to obtain specified total dry film thickness.

D. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

E. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.

G. Brush Application:

1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.

2. Brush apply all primers and first coats, unless otherwise permitted to use mechanical applicators.

H. Mechanical Applicators:

1. Use mechanical methods for paint application when permitted by governing ordinances, paint manufacturer, and approved by Engineer. If permitted, limit to only those surfaces impracticable for brush applications.

2. Limit roller applications, if approved by the Engineer, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.

3. Confine spray application to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and to other surfaces specifically recommended by paint manufacturer.

4. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of 2 coats in one pass.

I. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint work not in compliance with specified requirements as required by the Engineer.

J. Paint Work:

1. Undercoats shall be of approximate shade of final coat, but each coat shall be of slightly different tint. Each coat shall be inspected and approved before application of the succeeding coats, otherwise no credit for coat applied will be given and the work in question shall be recoated.

2. Finished surface shall be uniform in finish and color and free from brush marks, sagging, rippling and other imperfections. Should any coat be judged unsatisfactory, the coat shall be sandpapered or otherwise cleaned off and another coat applied. If the undercoating is disturbed, complete refinishing will be required.

3. Finish all returns, edges and recesses which will be exposed in the finished work and which will be seen from any angle to match the adjacent work.

4. Edges of paint or finish adjoining other materials or colors shall be sharp and clean without overlapping. Should workmanship be found defective, proper preparatory work shall be done and additional coats applied as necessary to give a finish in accordance with specified requirements.

K. After completion of each coat of paint, Contractor shall notify Engineer. After inspection, checking of film thickness and approval by Engineer, proceed with the succeeding coat.

3.5 PROTECTION

A. Furnish and lay drop cloths in all areas where painting work is being done to protect floors and all other adjacent work and materials from defacement.

B. Protect the installed work and the work of other contractors, whether to be painted or not, from the Work of this Section. Leave all such work undamaged. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to the Engineer.

C. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this contract and other contracts after completion of painting operations.

3.6 CLEANUP

A. During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday.

B. Upon completion of painting Work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by the Engineer.

3.7 INSTALLATION OF PIPE AND EQUIPMENT IDENTIFICATION SIGNS, NAMEPLATES AND TAGS

A. The name of the materials in each pipeline and, alongside this, an arrow indicating the direction of flow of fluids, shall be indicated on each pipe system. Titles shall also appear directly to each side of any wall the pipeline breaches, adjacent to each side of the valve, pump, filter, chemical tank, and all pieces of equipment. Pipe marking labels and arrows shall be located at intervals not to exceed 30 continuous linear feet apart, including any fraction thereof:

1. Material of Construction:

a. Acrylic plastic with UV inhibitor.

b. One piece.

c. Visibility - 360° on pipe sizes less than 6-inch diameter.

d. Minimum legend Display on pipe circumference - 4.

e. Mounting/Installation:

1) For pipes less than 6-inch dia. snap-type with no glues, adhesives or straps.

2) For pipes 6-inch dia. and larger - strap-around with nylon ties.

f. Letter size shall conform to ANSI STD.A13.1.

2. Product and Manufacturer:

a. Set Mark Pipe Markers as distributed by Seton Name Plate Co., New Haven, Connecticut.

b. Or approved equal.

B. Titles shall identify the contents by complete name at least once in each space through which it passes and thereafter by generally recognized abbreviations, letters or numerals as approved by the Engineer. Identification title locations shall be determined by the Contractor but in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Titles should be clearly visible from operating positions especially those adjacent to control valves.

C. Signs on large valves shall be located on or adjacent to the valve itself. Tags for smaller valves shall be attached to bonnet or flange bolts. Attachment of tags or signs to handwheels of valves will not be permitted.

D. Nameplates shall be located on equipment bases and on structures at readily visible levels in such positions relative to the equipment and structures as to prevent damage to the nameplate.

3.8 GUARANTEE

A. All work under this Section of the Specifications shall be guaranteed against checking, cracking, peeling, discoloration or other defects due to improper materials, or workmanship, due to improper preparation of the surfaces, or due to the painting, varnishing, etc., of surfaces which were not in proper condition to receive paint, varnish or other painter's materials and such unsatisfactory work shall be refinished in accord with the Guarantee requirements of the Contract Documents.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 10 14 23

PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building-identification signs.

B. Related Requirements:

1. Section 01 33 00, Submittals

2. Section 01 77 16, Contract Closeout

3. MEP and Electrical Sections

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.

2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Sign Schedule: Use same designations specified or indicated on MEP Drawings and coordinate with Owner the Building Name and Number for sign mounted on exterior wall.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.

b. Deterioration of embedded graphic image.

c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for signs.

2.2 SIGNS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. Signmojo.com, 2156 Amnicola Hwy, Chattanooga, TN 37406, 800.348.1349

C. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: “Santera” by Signmojo.com, 2156 Amnicola Hwy, Chattanooga, TN 37406, 800.348.1349, as indicated on Drawings.

2. Composite Phenolic-Core Sign: Solid phenolic panel core with integral subsurface graphic image covered with integral, polymeric face layer.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.

3. Mounting: Manufacturer's standard method for substrates indicated Surface mounted to wall with concealed anchors.

4. Surface Finish and Applied Graphics:

a. Integral Sheet Color: As selected by Director's Representative from full range of industry colors.

5. Text and Typeface: Accessible raised characters and Braille.

6. Flatness Tolerance: Sign panel shall remain flat or uniformly curved

under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

D. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: "Santera" by Signmojo.com, 2156 Amnicola Hwy, Chattanooga, TN 37406, 800.348.1349

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Beveled.

b. Corner Condition in Elevation: Square.

E. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Exposed Metal-Fastener Components, General:

a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

b. Fastener Heads: For nonstructural connections, use screws and bolts with tamper-resistant one-way-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

5. Internally brace signs for stability and for securing fasteners.

6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using method specified above.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Director's Representative.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 10 44 16

PORTABLE FIRE PROTECTION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install portable fire extinguishers.

2. The locations of the portable fire extinguishers are shown on the Drawings and specified herein.

3. The types of portable fire extinguishers required include the following:

a. Multi-purpose dry chemical extinguishers.

B. Coordination:

1. Coordinate the installation-of items that must be installed with the portable fire extinguishers.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Furnish portable fire extinguishers and accessories from only one manufacturer.

B. Requirements of Regulatory Agencies: Provide only portable fire extinguishers that are approved and labeled by UL in accordance with the State of New York Official Compilation of Codes, Rules and Regulations.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. UL, Fire Classification Rating.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's technical data, certification of UL rating, and installation instructions for all portable fire extinguishers required.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00, Submittals

B. Section 01 74 00, Construction Waste Management

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. General: Provide manufacturer's standard mounting bracket for portable fire extinguishers size as required.

B. Multi-Purpose Dry Chemical:

1. 20-pound capacity, enameled steel container with pressure indicating gauge, for Class A, Class B and Class C fires, UL rating 20A-120 BC.

2. Effective discharge time shall be 20 seconds minimum.

3. Manufacturer: Provide one of the following:

a. Model Cosmic 20E as manufactured by J. L. Industries.

b. Or equal.

C. Signs: Provide styrene, Y-shaped signs.

1. Background: White.

2. Lettering: "FIRE EXTINGUISHER," red or black.

3. Symbol: Of fire extinguisher, red.

4. Size: 7 inches by 12 inches.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor and his installer shall examine the substrate and conditions under which the portable fire extinguisher Work is to be installed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 INSTALLATION

A. Install wall mounted units in locations and at mounting of 3 feet-0 inches. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

B. Wherever exact locations of units are not clearly established, locate as directed by Engineer.

C. Install signs directly above portable fire extinguishers, securely mounted, attached to substrate in accordance with manufacturer's instructions. Install signs level and plumb.

D. Inform County of next required inspection and recharging date.

3.3 SCHEDULE

Type	Capacity (lbs)	Units	Location
A	20	1	Near exit door

3.4 EXTINGUISHER TYPES

A. Dry Chemical.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION+ +

NO TEXT ON THIS PAGE

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. These basic requirements apply to all Division 22 00 00 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all Plumbing and related work for this project, as required by the contract documents.

1.02 RELATED SECTIONS

A. Refer to Division 1 Specification.

1.03 REFERENCES

A. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers Guides and Standards, latest editions.

B. ASPE - American Society of Plumbing Engineers.

C. UL - Underwriters Laboratory.

D. NFPA - National Fire Protection Association.

1.04 REGULATORY REQUIREMENTS

A. Conform to New York State Building Code.

B. Plumbing: Conform to New York State Plumbing Code and the Fuel Gas code

C. Obtain permits, and request inspections from authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. The Contractor shall have the work indicated on the drawings and/or specified in each section performed by vendors or mechanics experienced and skilled in its implantation or by a “Specialist”, “Specialty Contractor” or “Specialty Subcontractor” under contractual agreement with the Contractor. These terms mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

B. Where the Contract Specifications require installation by a "Specialist," that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform such work under the manufacturer's direct supervision.

1.06 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed arrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.07 SCOPE OF WORK

A. This Contractor shall be responsible for coordinating his work with all other trades.

B. The Contractor shall provide all materials, labor, equipment, tools, appliances, services, hoisting, scaffolding, supervision and overhead for the furnishing and installing of all mechanical work and related work including but not limited to the following:

- Plumbing Fixtures
- Piping, Valves and fittings and specialties
  - Domestic systems
  - Drain, Waste, and Vent
- Hangers and Supports.
- Pipe Insulation
- Identification
- Coordination
- Phasing
- Shop Drawings
- As-Built Drawings and Maintenance Manuals
- Warrantees

PART 2 – PRODUCTS: NOT USED

PART 3 – EXECUTION

3.01 GENERAL

A. Construct all apparatus of materials and pressure ratings suitable for the conditions encountered during continuous operation.

B. Where corrosion can occur, appropriate corrosion resistant materials and assembly methods must be used including isolation of dissimilar metals against galvanic interaction. Resistance to corrosion must be achieved using the appropriate base materials. Coatings shall be restored to only when specifically permitted by the Specification.

C. Construct all equipment in accordance with requirements of all applicable codes. All pressure vessels and safety devices that fall within the scope of the ASME Code shall conform to the Code and bear the ASME label or stamp.

D. Match and balance all system components to achieve compatibility of equipment or satisfactory operation and performance throughout the entire operating temperature and control ranges. All installations shall be in accordance with manufacturer's recommendations.

E. The contractor shall warranty all work, including labor and materials, and equipment furnished and installed as part of this contract for a minimum period of year from the date of acceptance by the owner, in writing. Certain equipment, such as underground fuel tanks, may have longer warranties as indicated in the specifications. In such cases the longer of the two warranties shall prevail.

3.02 SHOP DRAWINGS AND SUBMITTALS (COORDINATE WITH DIVISION 01)

A. Shop drawings and samples shall be prepared and submitted in accordance with the requirements established in the contract and shall consist of all items listed in the following paragraph.

B. Manufacturer's data or shop drawings giving full information as to dimensions, materials, and all information pertinent to the adequacy of the submitted equipment shall be submitted for review. Shop drawings shall include, but not be limited to the following:

C. Submit all equipment noted and scheduled on plans including but not limited to the following:

- Piping, Valves and fittings and specialties for the following systems:
  - Domestic systems
  - Sanitary waste and vent
- Hangers and Supports.
- Pipe Insulation
- Hangers and Inserts
- Backflow preventers
- Piping Layout (3/8 scale)
- Coordinated plumbing plan indicating all other trades in the area of work

D. The contractor shall, upon award, submit a schedule for the Engineer's review indicating when each of the above shop drawings shall be submitted. Submittals shall be made in a timely manner as the project progresses in accordance with the Construction manager or General contractor's work schedules. The contractor shall allow sufficient time for the engineers to perform his review. A minimum of 10 business days shall be required. Untimely submittals shall be cause for the owner to make a delay against the contractor.

E. Demolition, purchase and or installation shall not begin until shop drawings pertaining to the equipment associated with any related potion of the work have been submitted.

E. Coordination shop drawings shall indicate all new lights, walls, piping, ductwork, structural elements, existing work, etc. and dimension locations of plumbing piping including elevations in relation to these items.

G. Where shop drawings have been reviewed by the Engineer, such review shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not substantiate any quantities and in any way relieve the Contractor from his responsibility nor the necessity of furnishing materials or performing work required by the Contract Drawings and Specifications.

H. Where substitutions are submitted for approval, the review shall be for general performance comparison to the specified product. Products shall not be reviewed for size, clearance or coordination with other trades. Coordination with other trades shall be the responsibility of the contractor. And changes to existing conditions or changes required to the work of other trades such as a result of substituted material or equipment approved or not shall be the responsibility of this contractor.

J Approval of Shop Drawings:

1. The Contractor shall be specifically responsible for checking equipment dimensions and clearances and confirming that equipment will fit into the designated space and connect properly to adjoining equipment and/or materials.

2. Submittals marked "Make Corrections Noted" give authority to proceed in accordance with the notes. However, if drawings are also marked "Amend and Resubmit", corrected drawings must be resubmitted for final review.

3. Submittals marked "Rejected" do not give authority to proceed with any portion of the work shown there-on. Drawings must be resubmitted.

4. Submittals marked "Rejected" or "Amend and Resubmit" shall include a specific written response to the engineer’s comments. Resubmission of a submittal without a written response to the engineer’s comments will be considered incomplete and shall be returned un-reviewed.

K. The contractor shall submit a composite shop drawing layout plan. This shall include all trades including plumbing mechanical and electrical trades. It shall indicate all equipment, piping conduit. It shall include an accurate architectural background. The composite drawing is for contractors and subcontractors to coordinate their work with the work of other trades prior to submitting to the engineer for review and approval. Identify equipment clearances as required for service and maintenance by the manufacture. Indicate conflicts for resolution.

L. Coordination submittals for piping, conduit and equipment within the building shall be made using 3-D software such as AutoCAD and shall include plan view sections and elevations as necessary to full illustrate and evaluate and resolve all structural, piping, major conduit and equipment for conflicts with other trades.

3.03 CHARTS AND TAGS

A. The Contractor shall provide three sets of charts and diagrams of all piping systems indicating the number and location of valves, etc.

B. All valves shall be designated with brass tags.

C. Comply with Supplemental and general Conditions

3.04 CODES AND STANDARDS

A. All equipment and installation methods shall conform to the applicable standards and/or recommendations set forth in but not limited to the following:

a. The New York State Building, Plumbing, and Energy Conservation Code

B. As well as all applicable referenced standards.

3.05 FEES & PERMITS

A. The Contractor shall obtain all permits and pay all fees required for his work.

3.06 PAINTING

A. All piping and equipment shall be painted in colors conforming with OSHA Standards.

3.07 RIGGING

A. Furnish all labor, materials and equipment required to rig equipment and materials.

B. The rigger shall secure any necessary permits and comply with all applicable Federal, State and local safety regulations. A copy of permits to be kept at both the project site and Engineer's Office.

C. The rigger shall have a minimum of five (5) years of practical experience and hold a master riggers license if required.

D. The procedure for rigging shall be submitted to the Engineer for review. All possible precautions should be taken to prevent damage to the structure, streets, sidewalks, curbs, lawns, etc.

3.08 CUTTING AND PATCHING

A. All cutting and patching required for piping, etc., passing through walls, floors, and roof shall be provided by the General Contractor under this contract unless otherwise noted. This Contractor shall be responsible for any damage done to the structure due to his negligence.

B. Patching materials and application shall match existing construction. It also includes patch to match any voids left behind by HVAC removals. MC will hire a skilled tradesman (mason, carpenter, etc.) to perform this work.

C. Where applicable, new holes for piping installation shall be core drilled.

D. Pipe Sleeves & Fire-stopping

1. Provide for all pipes and other elements passing through floors, walls, partitions and structural elements, sleeves as specified. Sleeves shall be of adequate diameter to allow for a minimum of 3/4 inches clear all around sleeve and pipe.
2. Where pipes penetrate fire rated assemblies, or where holes or voids are created to extend systems through fire rated assemblies (walls, floors, ceilings, structure, etc.); sleeves and fire-stopping systems shall be installed.

3.09 PROTECTION-COORDINATE WITH DIVISION 01

A. Recommendations and Provisions of ANSI Bulletin A10.2 and OSHA shall be complied with in-so-far as applicable to the work.

C. The Contractor shall provide temporary partitions or tarpaulins to protect adjacent spaces and/or equipment. He shall be responsible for any damage or injury to person or property of any character resulting from any act, omission, neglect or misconduct in his manner or method of executing his work.

D. The Contractor shall restore at his own expense such property to a condition similar or equal to that existing before such damage or injury in an acceptable manner.

E. The Contractor, furthermore, shall conduct his operations in such a manner as to prevent dust and debris from transferring on to adjoining property or into existing spaces.

F. All openings cut in walls, floors, roof or ceilings of the building, for pipe, etc., shall be closed off with box-type temporary protective enclosures of ¼" tempered hardboard, except when mechanics are actually working at the particular opening. Enclosures shall be constructed of fireproof 2x4 frame, four (4) sides covered and made completely dust and watertight.

F. All finished floor areas through which the contractor must pass with materials or equipment shall be protected with a layer of ¼" hardboard, "Masonite", laid with joints taped together. Roofs shall be protected with ½" plywood.

3.10 EQUIPMENT SUPPORTS

A. Provide supplementary steel dunnage, curbs, angle iron stands, etc., to properly set and install all equipment, including supports necessary to properly pitch piping.

3.11 WELDING

A. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

B. The handling and storage of all welding materials, acetylene and oxygen tanks, burners, and other equipment required for the execution of welding and cutting work shall be

subject at all times to the approval of the Owner and/or Architect. All welding materials and gas tanks shall be promptly removed from the premises upon completion of each day's work or stored in a manner satisfactory to the owner. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

C. Provide all temporary ventilation, and ventilation air systems required during welding operations as required by OSHA.

3.12 AS-BUILT DRAWINGS

A. The Contractor shall provide a complete set of As-Built drawings showing actual installation and locations of all piping and roof drains.

B. As-Built drawings shall be submitted as per contract requirements in accordance with Division 1.

3.13 CONDITIONS

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Section may be completed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings, and the Manufacturers' recommendations.

C. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.14 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved Shop Drawings except where specifically otherwise approved on the job by the Owner and/or Engineer.

B. Interferences: Avoid interference with structure, and with work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Engineer.

C. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, and that all items function properly, and that all adjustments have been made.

3.15 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the Engineer and by all other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work. After the work has been completely inspected, tested, and approved,

provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the owner.

3.16 BUILDING ACCESS

A. The Contractor shall inform himself fully regarding peculiarities and limitations of space available for the passage and installation of all equipment and materials under the Contract.

B. Verify and coordinate removal of existing construction to suit conditions. Provide all labor and material to facilitate installation.

3.17 COOPERATION WITH OTHER TRADES / PHASING

A. Cooperate with other trades in order that all systems in the work may be installed in the best arrangements.

B. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

C. This Contractor shall submit fully coordinated shop drawings showing all piping, ductwork and equipment, as well as relevant work of all other trades such as light, conduits, structural and steel, which may impact the final size or placement of piping, roof drains, etc.

D. The work shall be scheduled and phased in accordance with the requirements of the contract and the client. Prior to the commencement of work the contractor shall submit a schedule in writing to the Architect and Owner for approval. There shall be no shutdowns of any systems without prior written approval from the Owner. The contractor shall include in his bid all costs associated with providing temporarily piping, pumps, hot water heaters, to maintain operations outside the area of work while work is being performed. It shall also be noted that piping will have to be extended through the other areas to reach the area(s) under construction as part of this work. The contractor shall include in his bid all provisions to perform such phasing work. This note is typical for phases.

3.18 CLEANING

A. It is the intent of the Contract Documents that all work, including the inside of equipment be left in a clean condition. All construction dirt shall be removed from material and equipment.

B. All removed items shall be taken off the premises and discarded in a manner satisfactory to the Owner.

3.19 COMPLETENESS

A. It is the intent of the contract documents to provide complete systems. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is installed, adjusted, and operating as per the design intent in the opinion of the Engineer.

3.20 FIRE PREVENTION DURING HOT WORK

B. Before starting operations, the Contractor shall furnish trained personnel to provide fire watches for locations where hot work is to be performed. One fire watcher may observe several locations in a relatively small contiguous area. Contractor shall furnish suitable type, fully charged, operable portable fire extinguisher to each fire watcher.

C. The Contractor shall provide fire watchers who know how to operate the fire extinguisher, how to turn on a fire alarm and how to summon the fire department.

D. Before starting operations, take suitable precautions to minimize the hazard of a fire communicating to the opposite side of walls, floors, ceilings and roofs from the operations.

3.21 SAFETY MEASURES

A. Hot work shall not be done in or near rooms or areas where flammable liquids or explosive vapors are present or thought to be present. A combustible gas indicator (explosimeter) test shall be conducted to assure that each area is safe. The Contractor is responsible for arranging and paying for each test.

B. Insofar as possible, the Contractor shall remove and keep the area free from all combustibles, including rubbish, paper and waste within a radius of 25 feet from hot operations.

C. If combustible material cannot be removed, the Contractor shall furnish fireproof blankets to cover such materials. At the direction of the owner floors, walls, and ceilings of combustible material shall be wetted thoroughly with water before, during, and after operations sufficiently to afford adequate protection.

D. Where possible, the Contractor shall furnish and use baffles of metal or gypsum board to prevent the spraying of sparks, hot slag and other hot particles into surrounding combustible material.

E. The Contractor shall prevent the spread of sparks and particles of hot metal through open windows, doors, and holes and cracks in floors, walls, ceilings and roofs.

F. Cylinders of gas used in hot work shall be placed a safe distance from the work. The Contractor shall provide hoses and equipment free of deterioration, malfunction and leaks. Suitable supports shall be provided to prevent accidental overturning of cylinders. All cylinder control valves shall be shut off while in use with the gas pressure regulator set at 15 psi or less.

G. When hot work operations are completed or ended for the day, each location of the day's work shall be inspected by the Contractor 30 to 60 minutes after completion of operations to detect for hidden or smoldering fires and to ensure that proper housekeeping is maintained. Contractor shall cleanup the area of work at the end of each shift or workday.

H. Where sprinkler protection exists, the sprinkler system shall be maintained without interruption while operations are being performed. If operations are performed close to automatic sprinkler

heads, gypsum board sheets or damp cloth guards may be used to shield the individual heads temporarily. The heads shall be inspected by the Contractor immediately after hot work operations cease, to ensure all materials have been removed from the heads and that the heads have not been damaged.

I. Suitable type, fully charged, operable portable fire extinguisher shall be available at all times during hot work operations.

J. If any of the above safeguards are not employed, or are violated, the Contracting owners Representative may, by written notice, stop the work until compliance is obtained. Such stoppage shall not relieve the Contractor form performing his work within the Contract period for the Contract price.

3.22 USE OF OWNERS EQUIPMENT

A. The contractor shall not use any the owner's HVAC system or equipment, new or existing, for any purpose. The contractor shall provide temporary HVAC equipment, ductwork, power, and controls for use during construction for the purpose of ventilation, or heating during the construction process. All such equipment, ductwork, power, and controls shall be removed and the completion of work.

3.23 CLOSEOUT PROCEDURES

A. General Operating and Maintenance Instructions: Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel to provide necessary basic instructions in the proper operation and maintenance of the entire Work. Where installers are not expert in the required procedures, include instruction by the manufacturer's representatives.

B. Where applicable, provide instruction and training, including application of special coatings systems, at manufacturer's recommendation.

C. Provide a detailed review of the following items:
1. Maintenance manuals
2. Record documents and catalog cuts for each piece of equipment.
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning

D. Warranties, bonds, maintenance agreements, and similar continuing commitments.

E. Demonstrate the following procedures:
1. Start-up
2. Shut down

3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Periodic maintenance

F. Prepare instruction periods to consisting classroom instruction and or "hands-on" instruction for all equipment including the following.
   1. Fuel oil systems. Leak level and alarms, fuel pumps and fuel treatment.
   2. Gas fired equipment, hot water heaters, recirculation pump, and mixing valves.
   3. Domestic water systems including backflow testing requirements

G. Prepare a written agenda for each session and submit for review and approval. Include date, location, purpose, specific scope, proposed attendance, and session duration.

H. Record training sessions in digital format, format as selected by the Owner. Turn over digital files to the Owner after training has been completed.

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUSTAINABLE DESIGN OBJECTIVES

A. Westchester County requires the Contractor to implement practices and procedures to meet the project's environmental performance goals, which include:

1. Minimize the environmental impacts of the construction and operation of the project during the construction phase. The project shall implement the following procedures singly or in combination:
   a. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy, minimize environmental pollution, and to utilize recycled and/or recyclable materials.
   b. Reduce sources of potential Indoor Air Quality pollutants by controlled selection of materials and processes used in project construction. (015721)
   c. Minimize waste produced by construction through efficient construction practices and landfill diversion, as detailed in the Construction Waste Management Plan. (017419)
2. Products and processes that achieve the above objectives have been selected and included in the Construction Documents.

1.3 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of the Construction Staging and Waste Management Plant.

1.7 PROJECT CONDITIONS

A. Waste Management: Comply with the requirements of the Construction Waste Management Plan.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR SUSTAINABLE DESIGN – GENERAL

A. All field applied paints, coatings, sealants, sealer, adhesives in this section shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. All Products in this Section shall be free of Materials of Concern as noted in 015721-Indoor Air Quality Control (where achievable).

2.2 SLEEVES

A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A53/A53M, Schedule 80, with plain ends and welded steel collar, zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 80, zinc coated with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.3 STACK-SLEEVE FITTINGS

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

1. Jay R. Smith Mfg Co; a division of Morris Group International.
2. Wade; a subsidiary of McWane Inc.
3. Zurn Industries, LLC.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.4 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, LLC.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Designed to form a hydrostatic seal of 20 psig minimum.
2. Sealing Elements: EPDM-rubber or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel, Stainless steel or Stainless steel, Type 316.
4. Connecting Bolts and Nuts: Carbon steel, with ASTM B633 coating, Stainless steel or Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.5 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Rubber waterstop collar with center opening to match piping OD.

2.6 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section “Joint Sealants”.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with UL Listed/FM Approved fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Division 07 "Penetration Firestopping."

3.2 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Using waterproof grout, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 INSTALLATION OF SLEEVE-SEAL-FITTINGS

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
2. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.6 SLEEVE SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6: Steel pipe sleeves Sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves, or Steel pipe sleeves with Sleeve-seal fittings.
   1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Exterior Concrete Walls below Grade

   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch minimum annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch minimum annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch minim annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch minimum annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves or Stack-sleeve fittings.
   b. Piping NPS 6 and Larger: Steel pipe sleeves or Stack-sleeve fittings.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

B. One-piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece cast brass or split-casting brass with polished, chrome-plated finish.
c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass or split-casting brass with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.
8. Sight flow indicators.

B. Related Requirements:

1. Section 221119 "Domestic Water Piping Specialties" for water meters.
2. Section 331415 "Site Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

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

1. Trerice, H. O. Co.
2. Watts Water Technologies; a Watts company.
3. Weiss Instruments, Inc.
4. Weksler Glass Thermometer Corp.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

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. Trerice, H. O. Co.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Back angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

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. Trerice, H. O. Co.
    b. Weiss Instruments, Inc.
    c. Weksler Glass Thermometer Corp.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue[**or red**] organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

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. Ametek U.S. Gauge.
    b. Watts Water Technologies; a Watts company.
    c. Weiss Instruments, Inc.
    d. Weksler Glass Thermometer Corp.

2. Standard: ASME B40.100.
3. Case: Liquid-filled and Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass or Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ametek U.S. Gauge.
    b. Trerice, H. O. Co.
    c. Watts Water Technologies; a Watts company.
    d. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled and Sealed type; cast aluminum or drawn steel; 4-1/2-inch or 6-inch nominal diameter with back or front flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.

9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

A. Furnish one test-plug kit containing one thermometer, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.8 SIGHT FLOW INDICATORS

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

1. ARCHON Industries, Inc.
2. Dwyer Instruments, Inc.

3. Ernst Flow Industries.
4. John C. Ernst Co., Inc.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 150 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 PRESSURE GAGE AND THERMOMETER SCHEDULE

A. Install large size thermometers wherever space is available. Where space is limited use compact style.

B. Install all pressure gages locally unless space does not permit, or the location is not readily visible. Then use remote reading pressure gage and install in location accessible and readily visible, as close to the point of reading as possible.
1. Test plug with EPDM self-sealing rubber inserts.

C. Install pressure gages upstream and downstream of backflow preventers.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping:

1. 0 to 100 deg F.

3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping:

1. 0 to 200 psi.

B. Scale Range for Domestic Water Piping:

1. 0 to 160 psi.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Brass ball valves.
2. Bronze lift check valves.
3. Bronze swing check valves.
4. Bronze gate valves.
5. Iron gate valves.
6. Bronze globe valves.
7. Iron globe valves.

B. Related Sections:
1. Division 22 Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated or as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. All materials shall comply with NSF/ANSI Standard 732 for lead free.

I. Pressure reducing valves shall conform to ASSE 1003 or CSA B356. The valves shall have integral or separate strainer. The valve shall be designed to fail open.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

B. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Regular.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Disc: Bronze.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, NRS Bronze Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.6 IRON GATE VALVES

A. Class 150, OS&Y, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.7 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.

e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Bronze, PTFE, or TFE
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.8 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge, pin level.
2. Lift Check Valves: With stem upright and plumb.

F. All valves used in any system shall have a pressure class that exceeds the pressure of the system it is installed in.

G. All valves located at an elevation greater than 8’ above the finished floor and over 3” in size shall have chain operators that extend to the floor.

H. Provide pressure reducing valves for all domestic water services where the static pressure is 80 psi static pressure or greater.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated on plan, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or ball valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

b. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
5. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass Valves: May be provided with lead free solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass with brass trim. Class 150
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM, NBR seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron Gate Valves: Class 150.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.

B. Related Sections:
1. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations and product data for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

D. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. National Pipe Hanger Corporation.
   2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
   3. Rilco Manufacturing Co., Inc.
   4. Other manufacturers offering equivalent products.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

1. Pipe Stand: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections**.**

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Warning tape.
4. Pipe labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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. Brady Corporation.
    b. Craftmark Pipe Markers.

2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch anodized aluminum, 0.032-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

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. Brady Corporation.
    b. Craftmark Pipe Markers.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

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

1. Brady Corporation.
2. Craftmark Pipe Markers.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

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

1. Brady Corporation.
2. Craftmark Pipe Markers.

B. Material: Vinyl.

C. Minimum Thickness: 0.005 inch.

D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.

E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.

F. Maximum Temperature: 160 deg F.

G. Minimum Width: 2 inches.

2.4 PIPE LABELS

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

1. Brady Corporation.
2. Craftmark Pipe Markers.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.5 STENCILS

A. Stencils for Piping:

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. Craftmark Pipe Markers.

2. Lettering Size: Size letters in accordance with ASME A13.1 for piping At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

3. Stencil Material: Aluminum, brass, or fiberboard.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel in colors in accordance with ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

2.6 VALVE TAGS

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

1. Brady Corporation.
2. Craftmark Pipe Markers.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.04-inch or aluminum, 0.031-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire link chain or S-hook.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Include valve-tag schedule in operation and maintenance data.

2.7 WARNING TAGS

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

1. Brady Corporation.
2. Craftmark Pipe Markers.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Sign and Label Colors.

1. White letters on an ANSI Z535.1 safety-green background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where are-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF WARNING TAPE

A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.

B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.

C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in Division 09.

B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

C. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.

E. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

F. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

G. Pipe-Label Color Schedule:
1. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background.
2. Sanitary Waste Piping: White letters on a black background.

3.6 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Domestic Cold Water: 2 inches, round.

2. Valve-Tag Colors:

a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

3. List tagged valves in a valve schedule/chart minimum of 8.5” x 11” in aluminum frame with clear laminate face. Install within water service room or as directed by the facility. Indicate valve #, size, Service and Normally Open (N.O.) or Normally Closed (N.C.).

3.7 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Attach warning tags, with proper message, to equipment and other items where required.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size, as well as ASTM standard designation and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.

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. Owens Corning.

2. Preformed Pipe Insulation, Type II, Class 1: Unfaced.
3. Preformed Pipe Insulation, Type II, Class 2: With factory-applied ASJ jacket.
4. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials.

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. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

H. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F in accordance with ASTM C447. Comply with ASTM C547.

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. Johns Manville; a Berkshire Hathaway company.
b. Owens Corning.
c. ROCKWOOL.

2. Preformed Pipe Insulation: Type II, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

2.3 INSULATING CEMENTS

A. Mineral Wool Insulating Cement: Comply with ASTM C195.

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. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

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. Ramco Insulation, Inc.

C. Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

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. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. 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. Foster Brand; H. B. Fuller Construction Products.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric Adhesive: Solvent-based adhesive.

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. Aeroflex USA.
    b. Armacell LLC.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. K-Flex USA.

2. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F.
4. Service Temperature Range: 40 to 200 deg F.
5. Color: Black.
6. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Mon-Eco Industries, Inc.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

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. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Mon-Eco Industries, Inc.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

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. Johns Manville; a Berkshire Hathaway company.

b. P.I.C. Plastics, Inc.
c. Speedline Corporation.
d. The Dow Chemical Company.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

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. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.
d. Owens Corning.

2. Materials shall be compatible with insulation materials, jackets and substrates.
3. Fire and water-resistant, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. FSK and Metal Jacket Flashing Sealants:

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. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

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. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. 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. Johns Manville; a Berkshire Hathaway company.
    b. P.I.C. Plastics, Inc.
    c. Proto Corporation.
    d. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

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. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.

2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

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. Owens Corning.
b. Polyguard Products, Inc.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

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. 3M Industrial Adhesives and Tapes Division.
    b. Avery Dennison Corporation, Specialty Tapes Division.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

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. 3M Industrial Adhesives and Tapes Division.
    b. Avery Dennison Corporation, Specialty Tapes Division.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. 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. 3M Industrial Adhesives and Tapes Division.
    b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

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. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.

2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch-wide strips of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions with an FM Approved or UL Listed firestopping material or assembly.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches on center.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches on center and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

F. All insulation applications will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1-1/4 and Smaller: Insulation is one of the following:

a. Cellular Glass: 1/2 inch thick.
b. Flexible Elastomeric: 1/2 inch thick.
c. Mineral-Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation is one of the following:

a. Cellular Glass: 1 inch thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed.
1. All exposed cold-water piping and fittings which are exposed to view shall be completely covered with white Zeston 2000 PVC insulated piping and fitting covers from the floor up to 10’ above the floor. Apply as per manufacturer with perma weld adhesive. All labels and flow arrows shall be applied over PVC jacket.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings
2. Ductile iron pipe and fittings
3. Pipe joining materials
4. Specialty valves
5. Transition fittings
6. Dielectric fittings.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping, storm water piping and sanitary piping.
3. HVAC hydronic piping and Ductwork.
4. Electrical conduits.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager, Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Construction Manager's, Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. All materials shall comply with NSF/ANSI Standard 732 for lead free.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

C. Copper-Tube, Extruded-Tee Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Apollo Valves; Conbraco Industries, Inc.
   b. Elkhart Products Corporation.
   c. Mueller Industries, Inc.
   d. NIBCO INC.

2. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
   1. AWWA C153/A21.53, ductile iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

E. NPS 20 to NPS 46: 150 psig

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch-thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. Lead free

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. 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. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

   a. Pressure Rating: 150 psig at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

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. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. EPCO Sales, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Factory-fabricated, bolted, companion-flange assembly.

b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

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. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

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. Calpico, Inc.
b. Lochinvar Corporation.

2. Description:

a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level without pitch and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install pressure reducing valves at building water service after back flow preventer in all building where ethe static water pressure is greater than 80 PSI. pressure reducing valves shall be listed and labeled as being in conformance with ASSE 1003 and CSA B356.

3.4 DIELECTRIC FITTING INSTALLATION

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2and Smaller: Use dielectric couplings or nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Equipment: Cold-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports. Submit for engineers review and approval.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water distribution piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and joints.
2. (Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.)

E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.

F. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed soldered joints.

G. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backflow preventers.
   2. Hose Bibbs.
   3. Drain valves.
   4. Water meters.

B. Related Requirements:

   1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
   2. Section 221116 "Domestic Water Piping" for water meters.

1.2 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.

B. AMR: Automatic Meter Reading.

C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

   1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Watts Water Technologies; a Watts company.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Size: As indicated on Contract Drawings.
6. Design Flow Rate: As indicated on Contract Drawings.
7. End Connections: Flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight-through flow.
9. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Backflow-Preventer Test Kits:

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. Watts Water Technologies; a Watts company.

2. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

2.4 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Watts Water Technologies; a Watts company.
    c. Zurn Industries, LLC.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.5 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.6 WATER METERS

A. Fire Service-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Sensus; a Xylem brand.

2. Standard: AWWA C703.
3. Approval: NSF/ANSI Standard 61, Annex f and G
4. Pressure Rating: 150-psig working pressure.
5. Strainer: Sensus V-shaped, UL Listed/FM Approved
6. Registration: In hundreds cubic feet as required by utility company.
7. Operating Temperature: 33 deg F to 150 deg F
8. End Connections: Threaded or flanged.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Backflow preventers.
2. Hose Bibbs.
3. Water meters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.
2. Specialty pipe fittings.

B. Related Requirements:

1. Section 221319 "Sanitary Waste Piping Specialties".

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Shop Drawings: Include plans, elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's and Owner's written permission.

1.6 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Waste Piping: 300 ft. head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

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

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark.
2. ASTM A888 or CISPI 301.

C. CISPI, Hubless-Piping Couplings:

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. ANACO-Husky.
    b. Charlotte Pipe and Foundry Company.
    c. Dallas Specialty & Mfg. Co.
    d. MIFAB, Inc.

2. Standards: ASTM C1277 and CISPI 310.
3. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ANACO-Husky.
    b. Charlotte Pipe and Foundry Company.
    c. Dallas Specialty & Mfg. Co.
    d. MIFAB, Inc.

2. Standards: ASTM C1277 and ASTM C1540.
3. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ANACO-Husky.
    b. Charlotte Pipe and Foundry Company.
    c. Dallas Specialty & Mfg. Co.
    d. MIFAB, Inc.

2. Standards: ASTM C1277.
3. Description: Two-piece ASTM A48/A48M, cast-iron housing, stainless-steel bolts and nuts, and ASTM C 564, rubber sleeve with integral center pipe stop.

F. No Hub Fitting Restraints

1. Basis-of-Design Product: Subject to compliance with requirements, provide Holdrite: 117 Series No Hub Fitting Restraints or comparable
2. Description: CISPI Designation 301-12, large diameter no-hub cast iron fittings, 4” and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Install piping to allow application of insulation.

H. Make changes in direction for waste drainage piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

I. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

J. Install waste piping at the slope indicated in the Contract Drawings.

K. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.

L. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.

2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

C. Grooved Joints: Cut groove ends of pipe in accordance with AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Install No Hub Fitting Restraints on all piping 4 inch and over in size, shall be provided with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials shall not be used to accomplish this application solution.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42 clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.

B. Install hangers for cast-iron waste piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical runs of cast-iron waste piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect waste piping to exterior.

C. Connect waste piping to the following:
   1. Install horizontal backwater valves in accordance with manufacturer's specifications.
   2. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
   3. Equipment: Connect waste piping as indicated.

      a. Provide shutoff valve if indicated and union for each connection.
      b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with the following unless otherwise indicated:

   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

    a. Isolate test source and allow to stand for four hours.
    b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.8 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, waste piping NPS 4 and smaller are to be any of the following:

1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Aboveground, waste piping NPS 5 and larger are to be any of the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Watts Water Technologies; a Watts company.
    c. Zurn Industries, LLC.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled, or field modified to hang closed.
8. Extension: ASTM A74, Service Class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 -

1.1 RELATED DOCUMENTS

A. These basic Mechanical Requirements apply to all Division 23000 Sections.

B. The work of this Section consists of providing of all materials, labor and equipment and the like necessary and/or required for the complete execution of all HVAC and related work for this project, as required by the contract documents.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER RESPECTIVE SECTIONS OF THIS DIVISION

A. Motor starters shall be furnished under this Division. Refer to Specification Section 230513 Common motor requirements for HVAC equipment" for technical information.

1.4 REFERENCES

A. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers Guides and Standards, latest editions.

B. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.

C. ASME - American Society of Mechanical Engineers.

D. UL - Underwriters Laboratory.

E. NFPA - National Fire Protection Association.

1.5 REGULATORY REQUIREMENTS

A. Conform to New York State Building Codes and Energy Code as well as all local codes.

B. Mechanical: Conform to New York State Mechanical and Plumbing Code.

C. Obtain permits, and request inspections from authority having jurisdiction.

1.6 QUALITY ASSURANCE

A. The Contractor shall have the work indicated on the drawings and/or specified in each section performed by vendors or mechanics experienced and skilled in its implantation or by a "Specialist", "Specialty Contractor" or "Specialty Subcontractor" under contractual agreement with the Contractor. These terms mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

B. Where the Contract Specifications require installation by a "Specialist," that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform such work under the manufacturer's direct supervision.

1.7 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed arrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

1.8 SCOPE OF WORK

A. This Contractor shall be responsible for coordinating his work with all other trades.

B. The Contractor shall provide all materials, labor, equipment, tools, appliances, services, hoisting, scaffolding, supervision and overhead for the furnishing and installing of all mechanical work and related work including but not limited to the following:

1. Demolition of existing work including fans, louvers and miscellaneous equipment.
2. Unit heaters
3. Louvers and dampers
4. Fans.
5. Equipment Supports
6. Automatic temperature controls.
7. Vibration isolation.
8. Equipment supports.
9. Motor starters and disconnects.
10. Protection.
11. Identification.
12. Coordination.
13. Phasing.
14. Rigging.
15. Shop Drawings.
16. As-Built Drawings and Maintenance Manuals.
17. Warrantees.
18. Commissioning

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Construct all apparatus of materials and pressure ratings suitable for the conditions encountered during continuous operation.

B. Construct all equipment in accordance with requirements of all applicable codes. All pressure vessels and safety devices that fall within the scope of the ASME Code shall conform to the Code and bear the ASME label or stamp.

C. Match and balance all system components to achieve compatibility of equipment or satisfactory operation and performance throughout the entire operating temperature and control ranges. All installations shall be in accordance with manufacturer's recommendations.

D. Provide all controls, wiring, piping, valves, accessories and other components necessary to make all systems complete and operable.

E. The contractor shall warranty all work, including labor and materials, and equipment furnished and installed as part of this contract for a minimum period of year from the date of acceptance by the owner, in writing. Certain equipment, such as underground fuel tanks, may have longer warranties as indicated in the specifications. In such cases the longer of the two warranties shall prevail.

3.2 SHOP DRAWINGS AND SUBMITTALS (COORDINATE WITH DIVISION 01)

A. Shop drawings and samples shall be prepared and submitted in accordance with the requirements established in the contract and shall consist of all items listed in the following paragraphs.

B. Manufacturer's data or shop drawings giving full information as to dimensions, materials, and all information pertinent to the adequacy of the submitted equipment shall be submitted for review. Shop drawings shall include, but not be limited to the following:

C. Submit all Mechanical equipment noted and scheduled on plans including but not limited to the following:
1. Automatic Temperature Controls, Operation Sequences & Wiring Diagrams
2. Motor Starters disconnects and Controllers.
3. Vibration isolation
4. Unit heaters
5. Louvers and dampers
6. Fans
7. Hangers and Inserts
8. Equipment Supports and Vibration Eliminators
9. Coordinated Composite Drawings

D. The contractor shall, upon award, submit a schedule for the engineer's review indicating when each of the above shop drawings shall be submitted. Submittals shall be made in a timely manner as the project progresses in accordance with the Construction manager or General contractor's work schedules. The contractor shall allow sufficient time for the engineers to perform his review. A minimum of 10 business days shall be required. Untimely submittals shall be cause for the owner to make a delay against the contractor.

E. Demolition, purchase and or installation shall not begin until shop drawings pertaining to the equipment associated with any related potion of the work have been submitted.

F. Sheet metal shop drawings shall indicate all existing and/or new lights, walls, piping, structural elements, existing work, etc. and dimension locations of ductwork including elevations in relation to these items.

G. Where shop drawings have been reviewed by the Engineer, such review shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not substantiate any quantities and in any way relieve the Contractor from his responsibility nor the necessity of furnishing materials or performing work required by the Contract Drawings and Specifications. It does not relieve the contractor of the responsibility to perform all work to accepted industry standards and in a code compliant manor. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

H. Where substitutions are submitted for approval the review shall be for general performance comparison to the specified product. Products shall not be reviewed for size, clearance or coordination with other trades. Coordination with other trades shall be the responsibility of the contractor. And changes to existing conditions or changes required to the work of other trades such as a result of substituted material or equipment approved or not shall be the responsibility of this contractor.

I. Approval of shop drawings

1. The Contractor shall be specifically responsible for checking equipment dimensions and clearances and confirming that equipment will fit into the designated space and connect properly to adjoining equipment and/or materials.

2. Submittals marked "Make Corrections Noted" give authority to proceed in accordance with the notes. However, if drawings are also marked "Amend and Resubmit", corrected drawings must be resubmitted for final review.

3. Submittals marked "Rejected" do not give authority to proceed with any portion of the work shown there-on. Drawings must be resubmitted.

4. Submittals marked "Rejected" or "Amend and Resubmit" shall include a specific written response to the engineer's comments. Resubmission of a submittal without a written response to the engineer's comments will be considered incomplete and shall be returned un-reviewed.

J. The contractor shall submit a composite shop drawing layout plan. This shall include all trades including plumbing mechanical and electrical trades. It shall indicate all equipment, piping conduit. It shall include an accurate architectural background. The composite drawing is for

contractors and subcontractors to coordinate their work with the work of other trades prior to submitting to the engineer for review and approval. Identify equipment clearances as required for service and maintenance by the manufacture. Indicate conflicts for resolution.

K. Coordination submittals for equipment within the building shall be made using 3-D software such as AutoCAD and shall include plan view sections and elevations as necessary to full illustrate and evaluate and resolve all structural, piping, major conduit and equipment for conflicts with other trades.

3.3 CODES AND STANDARDS

A. All equipment and installation methods shall conform to the applicable standards and/or recommendations set forth in the New York State Building Code, Local Codes as well as all Codes and Standards listed in the general requirements sections of the specification.

3.4 FEES & PERMITS

A. The Contractor shall obtain all permits and pay all fees required related to this scope of work

3.5 PAINTING

A. All motors, fans and all other factory manufactured, and assembled apparatus shall be factory coated with one coat of primer and one coat of machinery enamel standard color at the factory and after installation, all finishes shall be cleaned and touched up to repair any damage incurred during construction.

B. All piping shall be painted in colors conforming with OSHA Standards. All new and existing exposed iron and supplementary dunnage steel shall be finished according to specifications.

C. All supports, nuts, bolts and hanger fasteners located outside shall be galvanized or nickel plated.

3.6 RIGGING

A. Furnish all labor, materials and equipment required to rig equipment and materials.

B. The rigger shall secure any necessary permits and comply with all applicable Federal, State and local safety regulations. A copy of permits to be kept at both the project site and Engineer's Office.

C. The rigger shall have a minimum of five (5) years of practical experience and hold a master riggers license if required.

D. The procedure for rigging shall be submitted to the Engineer for review. All possible precautions should be taken to prevent damage to the structure, streets, sidewalks, curbs, lawns, etc.

3.7 CUTTING AND PATCHING

A. All cutting and patching required for piping, ductwork, control conduits, etc., passing through walls, floors, and roof shall be provided by this Contractor under this contract unless otherwise noted.

3.8 PROTECTION - COORDINATE WITH DIVISION 01

A. Special protection is required for installation of a Derrick or other device for rigging purposes. This Contractor shall coordinate with the rigger to facilitate rigging work.

B. Recommendations and Provisions of ANSI Bulletin A10.2 and OSHA shall be complied with in-so-far as applicable to the work.

C. The Contractor shall provide temporary partitions or tarpaulins to protect adjacent spaces and/or equipment. He shall be responsible for any damage or injury to person or property of any character resulting from any act, omission, neglect or misconduct in his manner or method of executing his work.

D. The Contractor shall restore at his own expense such property to a condition similar or equal to that existing before such damage or injury in an acceptable manner.

E. The Contractor, furthermore, shall conduct his operations in such a manner as to prevent dust and debris from transferring on to adjoining property or into existing spaces.

F. All openings cut in walls, floors, roof or ceilings of the building, for conduit, pipe, ductwork, etc., shall be closed off with box-type temporary protective enclosures of ¼" tempered hardboard, except when mechanics are actually working at the particular opening. Enclosures shall be constructed of fireproof 2x4 frame, four (4) sides covered and made completely dust and watertight.

G. All finished floor areas through which the contractor must pass with materials or equipment shall be protected with a layer of ¼" hardboard, "Masonite", laid with joints taped together. Roofs shall be protected with ½” plywood

3.9 EQUIPMENT SUPPORTS

A. A.Provide supplementary steel dunnage, curbs, angle iron stands, etc., to properly set and install all equipment, including supports necessary to properly pitch piping.

3.10 WELDING

A. Welding and equipment shall conform to the American Welding Society’s Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

B. The handling and storage of all welding materials, acetylene and oxygen tanks, burners, and other equipment required for the execution of welding and cutting work shall be subject at all times to the approval of the Owner and/or Architect. All welding materials and gas tanks shall be promptly

removed from the premises upon completion of each day's work or stored in a manner satisfactory to the owner. Welding and equipment shall conform to the American Welding Society's Code for Welding in Building Construction, latest edition as well as state and local laws and ordinances.

C. Provide all temporary ventilation, and ventilation air systems required during welding operations as required by OSHA.

3.11 AS-BUILT DRAWINGS

A. The Contractor shall provide a complete set of As-Built drawings showing actual installation and locations of all new and existing equipment, piping, and ductwork in the entire building. Schedules shall be revised to indicate actual equipment installed.

B. As-Built drawings shall be submitted as per contract requirements in accordance with Division 1 and shall be submitted in paper format for review. Accepted as-builts shall then be submitted in AutoCAD format on hard disc.

3.12 CONDITIONS

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Section may be completed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings, and the Manufacturers' recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.13 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved Shop Drawings except where specifically otherwise approved on the job by the Owner and/or Engineer.

B. Interferences: Avoid interference with structure, and with work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Engineer.

C. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, and that all items function properly, and that all adjustments have been made.

3.14 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and accepted by the Engineer and by all other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work.

After the work has been completely inspected, tested, and approved, provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the owner.

3.15 BUILDING ACCESS

A. The Contractor shall inform himself fully regarding peculiarities and limitations of space available for the passage and installation of all equipment and materials under the Contract.

B. Verify and coordinate removal of existing construction and/or knock-down of equipment to suit conditions. Special attention should be given to equipment installation. Provide all labor and material to facilitate installation.

3.16 COOPERATION WITH OTHER TRADES PHASING

A. Cooperate with other trades in order that all systems in the work may be installed in the best arrangements.

B. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

C. This Contractor shall submit fully coordinated shop drawings showing all piping, ductwork and equipment, as well as relevant work of all other trades such as light, conduits, structural and steel, which may impact the final size or placement of piping, ductwork, equipment, diffusers and grilles.

D. The work shall be scheduled and phased in accordance with the requirements of the contract and the client. Prior to the commencement of work the HVAC contractor shall submit a schedule in writing to the Architect and owner for approval. There shall be no shutdowns of any systems without prior written approval from the Owner.

3.17 CLEANING

A. It is the intent of the contract documents that all work, including the inside of equipment be left in a clean condition. All construction dirt shall be removed from material and equipment.

B. All removed items shall be taken off the premises and discarded in a manner satisfactory to the Owner.

3.18 COMPLETENESS

A. It is the intent of the contract documents to provide complete systems. Completeness shall mean not only that all material and equipment has been installed properly, but that all material and equipment is installed, adjusted, and operating as per the design intent in the opinion of the Engineer and in accordance with generally accepted industry good practice.

3.19 FIRE PREVENTION DURING HOT WORK

A. Before starting operations, the Contractor shall furnish trained personnel to provide fire watches for locations where hot work is to be performed. One fire watcher may observe several locations in a relatively small contiguous area. Contractor shall furnish suitable type, fully charged, operable portable fire extinguisher to each fire watcher.

B. The Contractor shall provide fire watchers who know how to operate the fire extinguisher, how to turn on a fire alarm and how to summon the fire department.

C. Before starting operations, take suitable precautions to minimize the hazard of a fire communicating to the opposite side of walls, floors, ceilings and roofs from the operations.

3.20 SAFETY MEASURES

A. Hot work shall not be done in or near rooms or areas where flammable liquids or explosive vapors are present or thought to be present. A combustible gas indicator (explosimeter) test shall be conducted to assure that each area is safe. The Contractor is responsible for arranging and paying for each test.

B. Insofar as possible, the Contractor shall remove and keep the area free from all combustibles, including rubbish, paper and waste within a radius of 25 feet from hot operations.

C. If combustible material cannot be removed, the Contractor shall furnish fireproof blankets to cover such materials. At the direction of the owner floors, walls, and ceilings of combustible material shall be wetted thoroughly with water before, during, and after operations sufficiently to afford adequate protection.

D. Where possible, the Contractor shall furnish and use baffles of metal or gypsum board to prevent the spraying of sparks, hot slag and other hot particles into surrounding combustible material.

E. The Contractor shall prevent the spread of sparks and particles of hot metal through open windows, doors, and holes and cracks in floors, walls, ceilings and roofs.

F. Cylinders of gas used in hot work shall be placed a safe distance from the work. The Contractor shall provide hoses and equipment free of deterioration, malfunction and leaks. Suitable supports shall be provided to prevent accidental overturning of cylinders. All cylinder control valves shall be shut off while in use with the gas pressure regulator set at 15 psi or less.

G. When hot work operations are completed or ended for the day, each location of the days work shall be inspected by the Contractor 30 to 60 minutes after completion of operations to detect for hidden or smoldering fires and to ensure that proper housekeeping is maintained. Contractor shall cleanup the area of work at the end of each shift or workday.

H. Where sprinkler protection exists, the sprinkler system shall be maintained without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, gypsum board sheets or damp cloth guards may be used to shield the individual heads temporarily. The heads shall be inspected by the Contractor immediately after hot work operations cease, to ensure all materials have been removed from the heads and that the heads have not been damaged.

I. Suitable type, fully charged, operable portable fire extinguisher shall be available at all times during hot work operations.

J. If any of the above safeguards are not employed, or are violated, the Contracting owners Representative may, by written notice, stop the work until compliance is obtained. Such stoppage shall not relieve the Contractor form performing his work within the Contract period for the Contract price.

3.21 USE OF OWNERS EQUIPMENT

A. The contractor shall not use any the owner's HVAC system or equipment, new or existing, for any purpose. The contractor shall provide temporary HVAC equipment, ductwork, power, and controls for use during construction for the purpose of ventilation, or heating during the construction process. All such equipment, ductwork, power, and controls shall be removed and the completion of work.

3.22 CLOSEOUT PROCEDURES

A. General Operating and Maintenance Instructions: Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel to provide necessary basic instructions in the proper operation and maintenance of the entire Work. Where installers are not expert in the required procedures, include instruction by the manufacturer's representatives.

B. Where applicable, provide instruction and training, including application of special coatings systems, at manufacturer's recommendation.

C. Provide a detailed review of the following items:
1. Maintenance manuals
2. Record documents and catalog cuts for each piece of equipment.
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning

D. Warranties, bonds, maintenance agreements, and similar continuing commitments.

E. Demonstrate the following procedures:
1. Start-up
2. Shut-down
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization.

8. Periodic maintenance

F. Prepare instruction periods to consist of classroom and or "hands-on" instruction. Provide all equipment including the following:
   1. Unit Heaters.

Consult individual equipment specification sections for additional training requirements.

G. Prepare a written agenda for each session and submit for review and approval. Include date, location, purpose, specific scope, proposed attendance, and session duration.

H. Record training sessions in digital format, format as selected by the Owner. Turn over digital files to the Owner after training has been completed.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

1.4 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. NEMA MG 1 - Motors and Generators.

D. NFPA 70 - National Electrical Code.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL Component Recognition for appropriate sizes.

B. Conform to NFPA 70 applicable electrical code, Underwriters Laboratories, Inc., and NEMA

C. Conform to New York State energy code.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WARRANTY

A. Provide five-year manufacturer warranty for all motors larger than ½ horsepower.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Gould.
2. Century.
3. General Electric.
4. Square D

2.2 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

C. All electric motors of sizes and types as specified for driving mechanical equipment shall be provided under this section.

D. Electrical Service: All motors shall be 60 Hertz unless otherwise noted. Refer to Electrical Specifications for required electrical characteristics.

E. Motors: Design for continuous operation in 40° C environment, and for temperature rise in accordance with ANSI/NEMA MG limits for insulation class, Service Factor, and motor enclosure type. Motors shall be of sufficient size for duty to be performed.

F. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency, power factor.

G. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame. Size motor boxes to receive motor feeders and ground cable indicated on electrical drawing schedules.

H. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

I. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 MOTOR EFFICIENCY

A. Electric motors shall meet the minimum efficiency requirement of the following tables in accordance with International Energy conservation code when tested in accordance with DOE CFR 431. Performance data shall be certified by approved testing agency.

B. Subtype I motors – NEMA premium efficiency as per table NEMA MG 1 table 12-12 and International Energy Conservation code table 405.8(1). This shall apply to general purpose, T-frame, single speed, squirrel cage, induction type; 230/460-V, NEMA Designs A or B, continuous rated, 60 Hz, from 1 to 200 hp, 2-, 4- and 6-pole (3600-, 1800- and 1200-rpm), open and enclosed. Subtype I motors 250 hp to 500 hp motor efficiency shall be able NEMA MG 1 table 12-11 and International Energy Conservation Code table 405.8(1).

C. Subtype II motors – NEMA efficiency as per table NEMA MG 1 table 12-11 and International Energy Conservation code table 405.8(2). This shall apply to general purpose motors but can configured as U-frame motors; NEMA Design C motors; close-coupled pump motors; footless motors; vertical solid shaft normal thrust motors (as tested in a horizontal position); eight-pole (900 rpm) motors, and polyphase motors with a voltage of not more than 600 V (other than 230 or 460 V).

D. Minimum average full load efficiency of polyphase small electric motors up to 3 hp shall be in accordance with Table C405.8(3) of the International Energy Conservation Code

E. Minimum average full load efficiency for capacitor-start, capacitor-run and capacitor-start induction-run small electric motors up to 3 hp shall be in accordance with Table C405.8(4) of the International Energy Conservation Code.

2.4 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Service Factor: 1.15.

C. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

G. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.

H. Sound Power Levels: To NEMA MG 1.

I. Temperature Rise: Match insulation rating.

J. Insulation: Class B or better.

K. Code Letter Designation:

1. Motors [15] HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

L. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.5 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Use part winding Start above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

C. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

D. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, pre-lubricated sleeve ball bearings.

2.7 POWER FACTOR CORRECTION

A. Provide a capacitor for each three phase, single speed motor rated 3 HP or larger shall be provided to correct the full load power factor to 95%. The capacitor shall be mounted at the motor for connection across the motor terminals by Electrical Contractor

B. Capacitors:

1. Capacitors shall be totally enclosed, fused and with discharge resistors.
2. Capacitors based on nominal motor RPM shall be provided in accordance with the following table to correct power factor to 95% and verify sizes with motor manufacturer.

Motor HP	Capacitor KVAR 3600 RPM Motor	Capacitor KVAR 1800 RPM Motor
3	1.5	1.5
5	2	2
7.5	2.5	2.5
10	3	3
15	4	4
20	5	5
25	6	6
30	7	7
40	9	9
50	12	12
60	14	14

2.8 STARTERS

A. GENERAL

1. See specification Section 16485 and Division 1 for additional information.
2. Starters for motors operating at 120 volts shall be manual starters unless otherwise indicated. Starters for motors operating at other than 120 volts shall be magnetic starters.
3. All starters shall be enclosed. Enclosures shall be surface mounted NEMA 1 unless otherwise indicated.
4. Where weatherproof starters are required, the enclosure shall be NEMA 4.
5. It shall be verified that the correct overload heaters have been installed in the starter before energizing any motor. Sizing shall be based on motor nameplate current and taking into account any reduction in current due to power factor correction.
6. Alternate Manufacturers –

    a. Allen-Bradley
    b. Crouse-Hinds Co.
    c. Cutler-Hammer, Inc.
    d. General Electric Co.
    e. Square D Co.
    f. Westinghouse Electric Corp.

B. MANUAL STARTERS

1. Two-pole, toggle operated, thermal overload device in each phase leg, handle guard for padlocking toggle handle and with indicated control and signal devices.

2. Where a motor is controlled automatically by an interlock or pilot device, a “HAND-OFF-AUTO” switch shall be provided in the starter cover. Where the rating of the interlock or pilot device is inadequate to control the motor currents directly, a properly rated contactor shall be provided between the controlling device and the motor.

3. An “ON” pilot light shall be provided in the starter cover.

C. MAGNETIC STARTERS

1. Starters shall be sized in accordance with NEMA standards and the following table except that starters shall not be smaller than NEMA size 0. Starters shall be provided with one N.O. electrical holding interlock, under voltage protection and two additional auxiliary contacts within the same enclosure. NEMA size starters shall be provided as follows

STARTER SIZE	MAX HP AT 460 VOLTS
0	5
1	10
2	25

2. All starters shall be combination type with the starter and disconnect in the same enclosure. All starters shall be Type 2 coordination protected. Fuses shall be Bussman "Low Peak" type or equal sized at 125% of motor nameplate rating. Verify and coordinate requirements for fused disconnect switches with the Electrical Contractor prior to ordering starters.

3. Provide S.S.P.B. or H-O-A switches and pilot light in covers as required to facilitate control operation sequences.

D. CRITICAL FAULT

1. Where starters are not integral to equipment and are furnished and installed separately from equipment by the contractor, provide a 3-phase line voltage monitor by ICM Controls model 450 or approved equal. Unit shall be installed in the motor starter or in a separate enclosure with the same rating as the starter. It shall be arranged to monitor critical faults including phase loss or reversal, and when detected, de-energize the load. It shall monitor non-critical faults including high/low voltage, voltage unbalance and when detected, after a time delay de-energize the load.

PART 3 - EXECUTION

A. Suitable starting and controlling equipment and devices shall be furnished and installed as specified hereinafter and as shown on the Drawings. The starting equipment shall be arranged, generally, in control groups, or in certain cases, as isolated combination starters as specified or indicated. The Heating Ventilating and Air Conditioning Sequences of Operation, drawings and specifications shall be referred to for the manner of control, operation and monitoring of motors and the electrically operated equipment.

B. A starter and disconnect switch or combination motor starter disconnect shall be provided for every motor and each and every electrically operated piece of equipment by this contractor except where complete starters and controls are furnished by the manufacturer of the motor or piece of equipment. Starters shall be internally wired to provide the required control operation and monitoring. All control devices such as push buttons, break-glass stations, alternators, relays, pilot lights, etc., shall be provided as required for operation of mechanical equipment. All roof top and remotely located equipment shall have remote starters as located on plan and shall have

local disconnect switches. All equipment located in equipment rooms can use combination starters/disconnects located within line of site of controlled equipment. All starters and disconnect switches shall be in enclosures suitable for the environment in which they are installed. Starters and disconnect switches located in machine rooms shall use NEMA 1. Starters and disconnect switches located outdoors shall use NEMA 4x. Starters and disconnect switches located in machine rooms which are subject to potential water damage shall use NEMA 2

C. Starting equipment and devices specified in this section (and section 23 29 13 Variable Frequency Controllers), shall be furnished by the mechanical subcontractor and shall be installed by the Electrical subcontractor. In general, the mechanical subcontractor shall furnish all motor starters and disconnect switches except where they are an integral part of a motor control center MCC, in this case starters and disconnects shall be provided, (furnished and installed), by the electrical contractor. The mechanical contractor shall provide a separate local disconnect for each motor. The Electrical subcontractor shall also provide all wiring necessary to supply power to the electric motors specified under this section, including connections from the starters to the motors. Starters and disconnects shall also include variable frequency drives. Refer to the electrical plans for equipment which have starters in the MCC.

D. The mechanical Contractor shall furnish and install all wiring between control devices and controlled equipment furnished under this Section, including interlock control wiring between motor starters, and all automatic temperature control wiring. All wiring shall be installed in conformance with applicable codes and the requirements of the Electrical Division of the Specifications.

E. The Electrical Contractor shall furnish a 120-volt power source to temperature control panels and equipment requiring a separate 120-volt control power source. Power for control circuits for all devices connecting to motor starters shall be obtained from 120-volt control transformers provided in each starter operating at other than 120 volts. Provide transformers for all low voltage control systems as required.

F. Furnish detailed composite wiring diagrams and such other information necessary to assure the proper connection, operation and control of motorized equipment, including interlocks, automatic controls, safety controls and all auxiliary circuits.

G. All control units shall be furnished with a nameplate indicating which device or equipment it controls, the voltage. Additional nameplates on each push button, selector switch and pilot light indicating their functions shall be provided. Nameplates shall be laminated phenolic with white letters on black background, minimum 2” high.

H. All motors supplied either with equipment or installed separately that are to be used in conjunction with variable frequency drive shall be inverter duty motors.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fastener systems.
2. Equipment supports.
3. Miscellaneous Materials.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations and product data for the following:

1. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.2 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.-MPa), 28-day compressive strength.

C. Flashing:
1. Metal Flashing: 26gage galvanized steel.

2. Metal Counterflashing: 22 gage thick galvanized steel.

3. Flexible Flashing: 47 mil thick sheet butyl or other material compatible with roofing. Verify with roofing manufacturer.

4. Caps: Steel, 22-gage minimum; 16-gage at fire resistant elements.

D. Sleeves:
1. Ductwork Sleeve 18 gage Installation and Closure for Fire Rated Walls and Floors: Fire damper assembly with continuous angles on all sides as per NFPA-90A requirements.

2. Provide and install sleeves for all penetrations in accordance with Division 1.

E. Escutcheons:
1. Chrome plated cast brass escutcheons with set screws on all exposed piping at wall penetrations in finished spaces.

F. Hanger Rods:
1. Hanger Rods: Hot rolled steel threaded both ends, threaded one end, or continuous threaded. In accordance with the following schedule.

HANGER ROD SIZE SCHEDULE	
Pipe Size (in)	Min Rod Dia (in)
¾" to 2"	3/8"
½" to 3-1/2"	½"
4" to 5"	5/8"
6"	¾"
8" to 12"	7/8"
14"	1"
16" to 18"	1-1/8"
20"	1-1/4"
24"	1-1/2"
30"	1-7/8"

2. Hanger spacing shall be in accordance with the following schedule for maximum allowable distance. Provide hanger all changes in direction.

PIPE SUPPORT SPACING SCHEDULE		
Pipe Material/Size (in)	Maximum Horizontal Spacing (ft)	Maximum Vertical Spacing (ft)
Steel		
Up to 1 ¼"	8	15
1 ½" to 2 ½"	10	15
3" and over	12	15
Copper Pipe	8	10
Copper Tubing		
Up to 1 ¼"	6	10
1 ½" and over	8	10
PVC / HDPE		
Up to 1"	3	10
1 1/4" and over	4	10

2.4 VIBRATION ISOLATION HANGERS

A. Vibration isolation pipe hangers, pre-compressed and locked at the rated deflection by means of a resilient up-stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30□ capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

C. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

D. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply cold galvanizing-repair paint to comply with ASTM A 780. ZRC cold galvanizing compound

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports or metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

J. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.
9. Install vibration isolation hangers or supports on all piping connected to motor driven equipment for a distance of 20’ or the first two hangers.

K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.7 MISCELLANEOUS:

A. Equipment bases and supports.
   1. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Champers edges all four side.
   2. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment. Provide for all equipment, pumps, air handling units, etc.
   3. Refer to 23 0548 Vibration controls for HVAC piping and piping and equipment for vibration inertia bases.
   4. Construct supports of steel members. Brace and fasten with flanges bolted to structure. Provide rigid anchors for pipes after vibration isolation components are installed.

B. Flashing:
   1. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
   2. Flash piping projecting above finished roof surface with prefabricated steel reinforced boot and counter flashing sleeve.

C. Sleeves:
   1. Sleeves are required for all piping passing through walls and/or slabs. Sleeve diameter to be large enough to accommodate insulated piping.
   2. Sleeves through interior non-fire rated walls are to have annular space between pipe and sleeve filled with materials specified in Division 1.
   3. Sleeves thru fire rated walls to have annular space filled with fire stopping wrapping strips and expanding caulking applied with a caulking gun for a minimum depth of 3” or in another manner suitable for the application as recommended by the manufacturer. See Division 1.

D. Escutcheons:
   1. Provide escutcheons on all wall pipe penetrations that are visible outside MER spaces. All escutcheons shall be chrome plated.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels
   2. Warning signs and labels.
   3. Stencils.
   4. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

PART 2 - PRODUCTS

2.1 NAMEPLATES, TAGS, MARKERS, ETC

A. Manufacturer: W.H. Brady Co., Signmark Div

B. Acceptable manufacturers offering equivalent products

   1. Atlantic Engraving Company.

2. Seton Name Plate Co.
3. MSI Services
4. Substitutions as per Contract Requirements.

C. Description: Nameplates should be as specified in Division 1.

2.3 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Material and Thickness: Brass 0.032-inch, stainless steel 0.025-inch, aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: As per ANSI depending on service.
3. Background Color: As per ANSI depending on service.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: As per ANSI depending on service.
3. Background Color: As per ANSI depending on service.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.4 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/2 inch for name of units if viewing distance is less than 3 feet. For everything else the lettering shall be no less than 1”

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 1-1/2” letters minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents and incompatible primers, paints and encapsulants.

3.2 WARNING-TAG INSTALLATION

A. Write require message on and attach warning tags to equipment and other items where required.

3.3 INSTALLATION

A. Install tags, markers, etc. in conformance with Division 01.

B. Unless otherwise indicated, color shall conform with ANSI/ASME A13.1.

C. Install identifying devices after completion of coverings and painting.

D. Install plastic nameplates with corrosive-resistance mechanical fasteners or adhesive.

E. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Identify all equipment with nameplates or metal tags.

H. Identify control panels and major control components outside panels with nameplates.

I. Tag automatic controls, instruments, and relays.

J. Provide permanent labels for all controls and limits which state function of each control and control set-points.

END OF SECTION

SECTION 23 82 39.16

PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes propeller unit heaters with electric coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which propeller unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Other equipment

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products shall be one of the following:
1. QMark
2. Sterling
3. Modine
4. Vulcan

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in vertical and/or horizontal discharge configuration as scheduled with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Electric propeller unit heaters shall comply with UL 2021

D. Explosion-proof electric propeller unit heaters shall comply with UL 823.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Control Devices:

1. Wall-mounted, fan-speed switch, and thermostat by BMS contractor.

2.7 CAPACITIES AND CHARACTERISTICS

A. Heating Capacity are as scheduled or noted on plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers or spring hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Ground according to Division 26 Section “Grounding and Bonding for Electrical Systems."

B. Wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Belden Inc.
   2. General Cable; General Cable Corporation.
   3. Service Wire Co.
   4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, and Type XHHW-2.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
2. Hubbell Power Systems, Inc.
3. ILSCO.
4. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway, Mineral-insulated, metal-sheathed cable, Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
      a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
      b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency and testing agency's field supervisor.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. ILSCO.
5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

E. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Hangers.
      b. Steel slotted support systems.
      c. Trapeze hangers.
      d. Clamps.
      e. Turnbuckles.
      f. Sockets.
      g. Eye nuts.
      h. Saddles.
      i. Brackets.
   2. Include rated capacities and furnished specialties and accessories.

B. Delegated-Design Submittal: For hangers and supports for electrical systems.
   1. Include design calculations and details of trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M.
   2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
   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. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation, A Member of the ABB Group.
      f. Unistrut; an Atkore International company.
   2. Material: Galvanized steel.
   3. Channel Width: 1-5/8 inches.
   4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   5. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
         1) Hilti, Inc.
         2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti, Inc.
      4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.2 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
4. Republic Conduit.
5. Robroy Industries.
6. Southwire Company.
7. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
a. Material: Steel.
b. Type: compression.
3. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper B-Line, Inc.; a division of Cooper Industries.
   2. Hoffman; a brand of Pentair Equipment Protection.
   3. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hubbell Incorporated; Wiring Device-Kellems.
      b. MonoSystems, Inc.
      c. Wiremold / Legrand.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Technologies Company.
   2. Hoffman; a brand of Pentair Equipment Protection.
   3. Hubbell Incorporated.
   4. MonoSystems, Inc.

5. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
6. Robroy Industries.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:
1. Material: Cast metal.
2. Type: Fully adjustable .
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

L. Gangable boxes are allowed.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:
1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
   2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carson Industries LLC.
      b. Oldcastle Precast, Inc.
      c. Quazite: Hubbell Power Systems, Inc.
   2. Standard: Comply with SCTE 77.
   3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
   4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
   5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   6. Cover Legend: Molded lettering, "ELECTRIC."
   7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   8. Handholes 12 Inches Wide by 24 Inches Long or Larger as noted on contract drawings: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Tests of materials shall be performed by an independent testing agency.
   2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRC.

2. Concealed Conduit, Aboveground: GRC IMC EMT.
3. Undergroud Service Conduit: HDPE.
4. Underground Conduit: GRC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Boiler Room
   e. Crawl Space.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inchesof enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:
   1. Install surface raceway with a minimum 2-inchradius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:
   1.
   2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
   4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
   5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
   2. Install backfill as specified in Section 312000 "Earth Moving."
   3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
   4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
   5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.

b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Manholes.

1.2 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes, and other utility structures.
4. Include warning tape.
5. Include warning planks.

B. Shop Drawings:
1. Precast or Factory-Fabricated Underground Utility Structures:
a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole frame support rings.
e. Include Ladder details.
f. Include grounding details.
g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
h. Include joint details.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.

d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.4 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

D. Source quality-control reports.

E. Field quality-control reports.

1.5 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify Construction Managerand and Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

C. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. HPDE – per utility requirements.

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Christy Concrete Products.
2. Riverton Concrete Products.
3. Utility Concrete Products, LLC.
4. Utility Vault Co.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    a. Extension shall provide increased depth of 12 inches.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
10. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
    a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
11. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
12. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
    1. Color: Green.
    2. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
    3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
    4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    5. Cover Legend: Molded lettering, "ELECTRIC."
    6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
    7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
    8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. Quazite: Hubbell Power Systems, Inc.

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Armorcast Products Company.
b. Carson Industries LLC.
c. Christy Concrete Products.
d. Quazite: Hubbell Power Systems, Inc.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers made of polymer concrete.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Carson Industries LLC.
b. Christy Concrete Products.
c. Nordic Fiberglass, Inc.
d. Quazite: Hubbell Power Systems, Inc.

2.5 PRECAST MANHOLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Christy Concrete Products.
2. Riverton Concrete Products.
3. Utility Concrete Products, LLC.
4. Utility Vault Co.

B. Comply with ASTM C 858.

C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

D. Precast Manholes: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

E. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
1. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
2. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
3. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

F. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   1. Type and size shall match fittings to duct or conduit to be terminated.
   2. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

G. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

H. Ground Rod Sleeve: Provide a 3-inch PVC conduit sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.6 CAST-IN-PLACE MANHOLES

A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Materials: Comply with ASTM C 858 and with Section 033000 "Cast-in-Place Concrete."

C. Structural Design Loading: As specified in "Underground Enclosure Application" Article.

2.7 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Tests of materials shall be performed by an independent testing agency.
   2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or

archaeological sites to remain. Coordinate all site work with Site Contractor and Civil Engineer.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 310000 "Earthwok."

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Service Feeders 600 V and Less: HDPE in concrete-encased duct bank unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RGS in direct-buried duct bank unless otherwise indicated.

C. Ducts for Electrical Branch Circuits: RGS direct buried.

D. Underground Ducts Crossing Driveways and Roadways: RGS, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:
   1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO H-20 or Polymer concrete, SCTE 77, Tier 15 structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 Polymer concrete units, SCTE 77, Tier 8 structural load rating.
   4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
   5. Cover design load shall not exceed the design load of the handhole or box.

B. Manholes: Precast or cast-in-place concrete.
   1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
   2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 017300 "Execution."

3.5 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

I. Pulling Cord: Install 100-lbf- test nylon cord in empty ducts.

J. Concrete-Encased Ducts: Support ducts on duct separators.
   1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
   2. Width: Excavate trench 12 inches wider than duct bank on each side.
   3. Width: Excavate trench 3 inches wider than duct bank on each side.
   4. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
   5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
   6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
   7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
   8. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
   9. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
      b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
   10. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
   11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
   12. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
   13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

K. Direct-Buried Duct Banks:
1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
4. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.

b. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.

L. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

M. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:
1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
3. Comply with requirements in Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.

B. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below frost line, below grade.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Section 071353 "Elastomeric Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 071113 "Bituminous Dampproofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms as required for installation and support of cables and conductors and as indicated.

I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

J. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and

with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
   2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
   3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Silicone sealants.

B. Related Requirements:
   1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. CALPICO, Inc.
      c. Metraflex Company (The).
      d. Pipeline Seal and Insulator, Inc.
      e. Proco Products, Inc.
   2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Plastic.
   4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
   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. HOLDRITE.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.

B. Raceways and Cables Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. emedco.
      c. LEM Products Inc.
      d. Marking Services, Inc.
      e. Panduit Corp.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Marking Services, Inc.
      c. Panduit Corp.
      d. Seton Identification Products.

2.4 TAPES AND STENCILS:

A. Underground-Line Warning Tape
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. LEM Products Inc.
c. Marking Services, Inc.
d. Reef Industries, Inc.
e. Seton Identification Products.

2. Tape:
   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
   c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE."

2.5 Tags

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Carlton Industries, LP.
      c. LEM Products Inc.
      d. Marking Services, Inc.
      e. Panduit Corp.
      f. Seton Identification Products.

C. Write-On Tags:
   1. Polyester Tags: 0.010 inch 0.015 inch Insert dimension thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
   2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
   3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 Signs

A. Baked-Enamel Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Champion America.
   c. emedco.

C. Laminated Acrylic or Melamine Plastic Signs:
1. Engraved legend.
2. Thickness:
   a. For signs up to 20 sq. inches, minimum 1/16-inch-.
   b. For signs larger than 20 sq. inches, 1/8 inch thick.
   c. Engraved legend with black letters on white face.
   d. Punched or drilled for mechanical fasteners.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply stripes to the following finished surfaces:
1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
2. "POWER."

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    b. Colors for 208/120-V Circuits:
        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.
    c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

H. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for direct-buried cables and cables in raceways.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
      a. Power-transfer switches.
      b. Controls with external control power connections.

M. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
   1. Comply with NFPA 70E and ANSI Z535.4.
   2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

N. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

O. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:
    a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment To Be Labeled:
    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchboards.
    e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    f. Emergency system boxes and enclosures.
    g. Enclosed switches.
    h. Enclosed circuit breakers.
    i. Enclosed controllers.
    j. Variable-speed controllers.
    k. Push-button stations.
    l. Power-transfer equipment.
    m. Contactors.
    n. Remote-controlled switches, dimmer modules, and control devices.
    o. Battery-inverter units.
    p. Battery racks.
    q. Power-generating units.
    r. Monitoring and control equipment.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Standalone daylight-harvesting switching and dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Digital timer light switches.
7. Outdoor motion sensors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCYAND VACANCY SENSORS

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

1. Acuity Brands.

B. General Requirements for Sensors:

1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
2. Dual technology.
3. Integrated power pack.
4. Hardwired connection to switch ; and BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:

a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied,

or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A Sensor is powered from the power pack Wireless.
8. Power: Line voltage.
9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Wall or Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 2000 square feet when mounted48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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

1. Acuity Brands.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, manual "on," automatic "off" or SP, field-selectable automatic "on," or manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: as specified by architect.
11. Faceplate: Color matched to switch.
12. WattStopper; a Legrand® Group brand.

2.3 DIGITAL TIMER LIGHT SWITCH

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

1. Acuity Brands.

B. Description: Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in 20 minute increments.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 amps at 277-V ac for LED, and 1/4 horsepower at 120-V ac.
2. Integral relay for connection to BAS.
3. Voltage: Dual voltage - 120 and 277 V.
4. Color: As selected by Architect..
5. Faceplate: Color matched to switch.

2.4 HIGH-BAY OCCUPANCY SENSORS

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

1. Acuity Brands.

B. Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
3. Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
4. Power: Line voltage.
5. Operating Ambient Conditions: 32 to 149 deg F.
6. Mounting: Threaded pipe.
7. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
8. Detector Technology: PIR.
9. Power and dimming control from the luminaire ballast that has been modified to include the dimming capacitor.

C. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet.

D. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 22 13

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Eaton.
2. General Electric Company.
3. Square D; by Schneider Electric.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Bolted.

D. Enclosure: Ventilated.

1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.
    a. Finish Color: Gray weather-resistant enamel.
5. .

E. Taps for Transformers 3 kVA and Smaller: None.

F. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

J. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

2.4 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
2. Ratio tests at rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:

    a. High-voltage to ground.
    b. Low-voltage to ground.
    c. High-voltage to low-voltage.

9. Temperature tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers level and plumb on a concrete base with vibration-dampening supports.

B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base according to manufacturer's written instructions.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, and grounding.
c. Verify that resilient mounts are free and that any shipping brackets have been removed.
d. Verify the unit is clean.
e. Perform specific inspections and mechanical tests recommended by manufacturer.
f. Verify that as-left tap connections are as specified.
g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.
b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.
   2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 FIELD CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
      b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Owner's written permission.
   3. Comply with NFPA 70E.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 4.
      c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   2. Height: 84 inches maximum.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
   4. Finishes:
      a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel.

F. Incoming Mains:
   1. Location: Convertible between top and bottom.
   2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 20 percent.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company; GE Energy Management - Electrical Distribution.
   3. Siemens Energy.
   4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company; GE Energy Management - Electrical Distribution.
   3. Siemens Energy.
   4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
   3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).

4. Subfeed Circuit Breakers: Vertically mounted.
5. MCCB Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
    i. Multipole units enclosed in a single housing with a single handle.
    j. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.
    1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:
1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
   1. Measure loads during period of normal facility operations.
   2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
   4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. USB charger devices.
3. Twist-locking receptacles.
4. Weather-resistant receptacles.
5. Snap switches.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Floor service outlets and poke-through assemblies.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. UTP: Unshielded twisted pair.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
   2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
   2. Hubbell Incorporated; Wiring Device-Kellems.
   3. Leviton Manufacturing Co., Inc.
   4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 12 V dc, 2.0 A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Eaton (Arrow Hart).
      b. Hubbell Incorporated; Wiring Device-Kellems.
      c. Leviton Manufacturing Co., Inc.
      d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, Type A.
4. Line Voltage Receptacles: Dual, two pole, three wire, and self-grounding.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration as indicated on drawings, and UL 498.
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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description:
1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.
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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

C. GFCI, Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.
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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Pass & Seymour/Legrand (Pass & Seymour).

D. Toggle Switches, Square Face, 120/277 V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

E. Lighted Toggle Switches, Square Face, 120 V, 20 A: Comply with NEMA WD 1 and UL 20.
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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: With neon-lighted handle, illuminated when switch is "off."

F. All branch circuits rated at 15 amperes shall only have receptacles rated at 15 amperes connected to it.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.
   3. Material for Unfinished Spaces: Galvanized steel.
   4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

2.10 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Pass & Seymour/Legrand (Pass & Seymour).
   3. Square D; by Schneider Electric.
   4. Thomas & Betts Corporation, A Member of the ABB Group.
   5. Wiremold / Legrand.

B. Description:
   1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
   2. Comply with UL 514 scrub water exclusion requirements.
   3. Service-Outlet Assembly: Pedestal type with services indicated.
   4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
   5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
   7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

2.11 FINISHES

A. Device Color:
   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
   1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cartridge fuses rated 600 V ac and less for use in the following:
      a. Control circuits.
      b. Switchboards.
      c. Enclosed controllers.
      d. Enclosed switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles. Include the following for each fuse type indicated:
   1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   2. Coordination charts and tables and related data.
   3. Fuse sizes for elevator feeders and elevator disconnect switches.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:
   1. Ambient temperature adjustment information.
   2. Current-limitation curves for fuses with current-limiting characteristics.
   3. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.5 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussmann; a division of Cooper Industries.
3. Littelfuse, Inc.
4. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
3. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
1. Service Entrance: Class L, time delay.
2. Feeders: Class RK1, time delay.
3. Motor Branch Circuits: Class RK1, time delay.
4. Power Electronics Circuits: Class J, high speed.
5. Other Branch Circuits: Class J, fast acting.
6. Control Transformer Circuits: Class CC, time delay, control transformer duty.
7. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company.
   3. Siemens Industry, Inc.
   4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
   5. Lugs: Mechanical type, suitable for number, size, and conductor material.
   6. Service-Rated Switches: Labeled for use as service equipment.
   7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company.
   3. Siemens Industry, Inc.
   4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
   4. Lugs: Mechanical type, suitable for number, size, and conductor material.
   5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 4.
   3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
      b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 26 51 19

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior solid-state luminaires that use LED technology.
   2. Lighting fixture supports.

B. Related Requirements:
   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
   6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. Rated lamp life of 35,000 hours.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: As indicated on Plans.
   1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

J. Housings:
   1. Extruded-aluminum housing and heat sink.
   2. powder-coat finish.

2.2 DOWNLIGHT

A. See Plans for manufacturers.

B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.3 LINEAR INDUSTRIAL

A. See Plans for manufacturers.

B. Minimum 5,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Housing and heat sink rated to the following:
1. NEMA 4X.
2. IP 54.
3. IP 66.
4. Marine and wet locations.
5. CSA C22.2 No 137.

2.4 RECESSED LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.5 STRIP LIGHT

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.6 SURFACE MOUNT, LINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.7 SURFACE MOUNT, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.8 SUSPENDED, LINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

2.9 SUSPENDED, NONLINEAR

A. See Plans for manufacturers.

B. Minimum 2,000 lumens. Minimum allowable efficacy of 85 lumens per watt.

C. Integral junction box with conduit fittings.

2.10 MATERIALS

A. Metal Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. prismatic acrylic
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:
1. Extruded-aluminum housing and heat sink.
2. powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter, shape, size, wattage, and coating.

c. CCT and CRI for all luminaires.

2.11 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.12 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Provide support for luminaire without causing deflection of ceiling or wall.
   4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:
   1. Secured to outlet box.
   2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
   3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
   1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
   2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length.
   3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
   4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
   3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26 52 19

EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Emergency lighting units.
   2. Exit signs.
   3. Luminaire supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
   1. Include data on features, accessories, and finishes.
   2. Include physical description of the unit and dimensions.
   3. Battery and charger for light units.
   4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
   5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
      a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:
1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Power Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
   2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

G. Bulb Shape: Complying with ANSI C79.1.

H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
   1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.

2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet.
4. Nightlight Connection: Operate lamp continuously at 40 percent of rated light output.
5. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Battery: Sealed, maintenance-free, nickel-cadmium type.
7. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
8. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:
1. See Plans for manufacturers.
2. Emergency Luminaires: as indicated on Interior Lighting Fixture Schedule, with the following additional features:
    a. Operating at nominal voltage of 120 V ac or 277 V ac.
    b. Internal emergency power unit unless powered via UPS system, See Plans for circuiting information and details.
    c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

C. Emergency Lighting Unit:
1. See Plans for manufacturers.
2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule.
3. Operating at nominal voltage of 120 V ac or 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. Two LED lamp heads.

7. Internal emergency power unit.

D. Remote Emergency Lighting Units:
1. See Plans for manufacturers.
2. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule.
3. Operating at nominal voltage of 120 V ac or 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. LED lamp heads.
7. External emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. See Plans for manufacturers.
2. Operating at nominal voltage of 120 V ac or 277 V ac.
3. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
4. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
5. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
6. Master/Remote Sign Configurations:
   a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply and battery for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.4 MATERIALS

A. Metal Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:
1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Prismatic acrylic.

2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:
1. Extruded aluminum housing and heat sink.
2. powder coat finish.

E. Conduit: Electrical metallic tubing or Flexible metallic conduit, minimum 3/4 inch in diameter.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
   1. Sized and rated for luminaire and emergency power unit weight.
   2. Able to maintain luminaire position when testing emergency power unit.
   3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
   4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:
   1. Secure to any required outlet box.
   2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
   3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:
   1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
   2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
   1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
      a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   2. Conduct short-duration tests on all emergency lighting.

END OF SECTION

SECTION 26 56 19

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
   2. Luminaire supports.

B. Related Requirements:
   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
      a. Manufacturer's Certified Data: Photometric data certified by manufacturer’s laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of the following:
1. Luminaire.

B. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Source quality-control reports.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. Lamp base complying with ANSI C81.61 or IEC 60061-1.

E. Bulb shape complying with ANSI C79.1.

F. CRI of minimum 70. CCT of 4000 K.

G. L70 lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: 277 V ac.

K. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. Area and Site:
1. See Plans for manufacturers.
2. Luminaire Shape: Square.
3. Mounting: Building.
4. Luminaire-Mounting Height: As indicated on architectural plans.
5. Distribution: Type IV.
6. Diffusers and Globes: Prismatic acrylic.
7. Housings:
   a. Extruded-aluminum housing and heat sink.
   b. powder-coat finish.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during

relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
   1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
   1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
   2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage and coating.
      c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
   a. Color: As indicated on plans.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:
1. Attached to structural members in walls.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 BOLLARD LUMINAIRE INSTALLATION:

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Illumination Tests:
   1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
      a. IES LM-5.
      b. IES LM-50.
      c. IES LM-52.
      d. IES LM-64.
      e. IES LM-72.
   2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.9 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall perform all excavating, backfilling, compaction, testing and disposing of earth materials as shown, specified, and required for the purpose of construction of the Work as specified herein or indicated on the contract documents.

2. Also included is earthwork necessary for removal and replacement of utilities, structures, foundations, sub-surface vaults, pavements, and other facilities as required to complete the Work as shown and specified. All materials necessary for fill, backfill, granular embedment and crushed stone are included.

3. All necessary preparation of subgrade is included.

4. Disposal of Excavated Materials: All excavated materials encountered/generated during construction shall be managed on-site in accordance with the minimum soil erosion and sediment control procedures outlined in the Contract Documents. The Contractor shall coordinate the location of the excavated material stockpile with the Owner. Contractor shall be responsible for implementing all soil erosion measures necessary to isolate the excavated materials from the surrounding environment. Contractor shall also be responsible for the proper characterization (i.e., testing), handling, loading and off-site transportation and disposal of all excess soil encountered/generated throughout the performance of the work. The Contractor shall provide his own data for this purpose. The Contractor may direct load excavated soil into the Contractor's disposal trucks or shipping containers for off-site transportation and disposal, provided that the soil to be excavated has been properly characterized in-situ, as approved by the Owner and the disposal facility.

5. Soil that shall be excavated as part of this project has been sampled and determined to exceed the New York State Department of Environmental Conservation's (NYSDEC's) Unrestricted Use Soil Cleanup Objectives (SCOs). As a result, it appears that all excavated material may be disposed off-site as nonhazardous waste, as further outlined in the below paragraph; however, the actual characterization and management of the soil shall be determined by the Contractor's samples. The nature and extent of contamination within the area of work is detailed in the Soil Sample Analysis prepared for the site (refer to Appendix 2).

6. All labor, materials, equipment, and incidentals to perform all work under this Section shall be included in the base bid. No separate payment will be made for any Work associated with the disposal of nonhazardous waste indicated to be included in the base bid, as the cost of said work shall be deemed included in the Contract.

B. Sources of Materials:

1. General fill materials shall be obtained from on-site excavation work and/or off-site sources.

1. Select fill materials shall be obtained from on-site excavation work and/or off-site sources.

2. Engineered fill materials shall be obtained from on-site excavation work and/or off-site sources.

3. Nonfrost susceptible fill material shall be obtained from off-site sources.

4. Crushed stone materials shall be obtained from off-site sources.

5. Topsoil, except for topsoil stripped from the work areas, shall be obtained from off-site sources.

C. Related Work Specified Elsewhere:

1. Section 02 80 00, Waste Transportation and Disposal

2. Section 03 30 00, Cast-in-Place Concrete.

3. Section 02 32 19, Exploratory Excavations (Test Pits)

1.2 QUALITY ASSURANCE

A. Permits and Regulations: Contractor shall perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Design Criteria:

1. Contractor shall be wholly responsible for installing and operating the system used to accomplish the sheeting and bracing shown on the Drawings, or otherwise required.

C. Tests:

1. An independent testing laboratory shall be employed and paid for by the Contractor to perform the required tests.

2. Required Tests:

   a. Select Fill Samples: Gradation, ASTM D 422.

   b. Compacted Select Fill: Compaction, ASTM D 698 and ASTM D 1556.

   c. Optimum moisture - maximum density curve for each soil used for backfill.

   d. Field Density Tests on each lift of backfilled material: ASTM D1556, ASTM D2167 or ASTM D6938.

3. Testing of materials for approval shall include, but shall not be limited to, the following (all tests to be performed after screening or processing of the material).

   a. Grain size distribution in accordance with ASTM D422, including hydrometer analysis.

   b. Characterization in accordance with ASTM D2487.

   c. Moisture/Density relationship in accordance with ASTM D698 (Standard Proctor).

   d. Chemical Analysis: Chemical analysis of soil shall be performed in accordance with NYSDEC Division of Environmental Remediation DER-10 ("Technical Guidance for Site Investigation and Remediation"). Analysis shall include Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides, TCL herbicides, TCL polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, hexavalent chromium, and cyanide. Sample collection and analysis shall be in accordance with the SW-846 procedures. Sample analysis shall be performed by a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory. The results of the chemical analysis shall meet the requirements of the New York State Department of Environmental Conservation (NYSDEC) Unrestricted Use Soil Cleanup Objectives found at 6 NYCRR Part 375-6.8(a).

4. Testing laboratory will submit copies of the following reports directly to Engineer with a copy to Contractor:

   a. Tests on borrow material.

b. Field density tests.

c. Optimum moisture-maximum density curve for each soil used for backfill.

d. Results of contamination testing.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit, for information purposes only, shop drawings of sheeting and bracing systems for excavations deeper than five (5) feet. Information supplied shall include, as a minimum, type and size of sheeting to be used, extent of sheeting and tip and top elevations.

2. Shop drawings shall be prepared and signed by a Professional Engineer licensed in the State of New York.

3. Submit plans of open cut excavations showing limits of the excavation at grade where not shown on the Contract Drawings, where applicable.

B. Independent Testing Laboratory: Prior to conducting the required tests, the Contractor shall submit, to the Engineer, for approval, the name of the independent test laboratory which will facilitate the required testing.

C. Samples:

1. At least two weeks prior to the date of anticipated use, the Contractor shall submit, to the Owner, for approval, a representative sample of all on-site and off-site material required. The Contractor shall notify the Owner in writing of the source of each sample.

2. The Contractor shall provide, along with the above samples, the required test results, excluding the field density test.

C. Disposal Sites:

1. List of disposal sites for unsuitable materials and all required permits for use of the sites.

D. Manufacturer's Data: Submit for approval manufacturer's specifications, performance characteristics and operating instructions for the compaction equipment.

E. Submit Contractor’s proposed methods for the management of excavated soil, including but not limited to methods for characterization, an estimate of the soil

volume to be excavated, number and locations of proposed samples and type of analyses, whether the soil will be stockpiled and sampled ex-situ or characterized in-situ so that the material can be direct loaded into the Contractor's disposal trucks or shipping containers, proposed locations for soil management areas, methods for protecting any stockpile or storage areas and preventing cross-contamination, and proposed disposal facility including the facility's sampling requirements.

1.4 JOB CONDITIONS

A. Existing Structures:

1. Shown on the Drawings are certain utilities and surface and underground structures located on or adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the Contractor. Contractor shall explore ahead of the required excavation to determine the exact location of all structures and utilities. They shall be supported and protected from injury by the Contractor. If they are broken or injured, they shall be restored immediately by the Contractor at no additional cost to the Owner.

2. Prior to execution of the Work, the Contractor shall check and verify governing dimensions and elevations. The Contractor and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

B. Locating Underground Utilities:

1. The locations of all utilities shown on the contract drawings are based on available in-house information furnished by the Owner and utility companies and public agencies with lines and property in the vicinity of the proposed work areas and are not guaranteed to be complete or accurate. The contractor shall obtain utility markouts on all public and private properties in accordance with all local and state requirements where work under this contract is to be performed. Prior to any excavation or construction, the contractor shall notify the Owner, all utility companies and applicable agencies and request a markout of their lines and properties in the field in the area of the proposed work.

2. Schedules for maintenance of utility markouts on public and private property shall be consistent with New York State law throughout the duration of the Contract.

3. During construction/excavation, the contractor shall locate each utility by hand digging methods prior to the use of mechanical excavation equipment. During construction/excavation, if the contractor encounters evidence of suspected unmarked utilities, such as magnetic tape or other underground

markers, the contractor shall promptly determine the location of the suspected utility, if any, before proceeding with the work. The contractor shall cooperate with the Owner and the utility companies involved to avoid delay or interference of service normally performed by their lines and properties.

4. The Contractor shall take extreme caution against damaging utilities when excavating, sheeting and backfilling, during construction of test probes and test pits and while performing the work required under this Contract.

5. The contractor shall be responsible for all costs associated with pre-project construction utility survey(s)/markout(s), and utility as-builts for this project, as well as protection and hand digging operations to verify location of all utilities during construction.

C. Test Pits (Exploratory Excavations)

1. Test pit excavation shall consist of pavement saw-cutting and removal (if applicable) and earth excavation ordered, in writing, by the Engineer for exploratory purposes to determine the location and/or depth of existing sub-surface utilities, structures, etc.

2. Material excavated form test pits can be re-used to backfill the test pit if first approved by the Engineer.

3. Existing utility systems and service lines to remain and those encountered during excavation, if damaged, shall be repaired at the Contractor's expense.

4. Existing utility systems and service lines to remain and those encountered during excavation, if damaged, shall be repaired at the Contractor's expense.

D. Existing Utilities:

1. Locate existing underground utilities in the areas of Work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

2. Perform test pits as shown on the Contract Drawings or as directed by the Engineer or as required to perform the work.

3. Should uncharted or incorrectly charted piping or utilities be encountered during excavation, consult Owner in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Engineer. Relocate or offset all utilities as required to perform the new work, at no additional cost to the Owner.

4. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by Engineer.

5. Demolish and completely remove existing underground utilities indicated to be removed.

E. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this Work and post with warning lights. Contractor shall provide "Jersey" type concrete barriers with reflective tape where shown on the Contract Drawings or as required by roadway Owner. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by contractor's operations.

3. Consult Engineer and obtain his approval before removing, trimming, or disturbing trees, shrubs, plants, fences, rails, walks, structures or other facilities that are encountered on the line of the excavation.

4. Structures, utilities, sidewalks, pavements and other facilities removed or disturbed shall be replaced to their original condition, unless otherwise shown, specified or directed.

F. Dust Control: Contractor shall conduct all of his operations and maintain the area of his activities, including sweeping and sprinkling of roadways, so as to minimize creation and dispersion of dust. In addition, Contractor shall be responsible for controlling dust caused by his operation of vehicles and equipment, clearing or for any reason whatever.

G. Odor Control: As an odor abatement measure, cover, at the end of each work day, all areas of organic or odorous material which were exposed during excavation with a minimum 6-in and a maximum 24-in deep of clean fill. Excavated organic or odorous material shall be immediately removed off-site and shall not be stockpiled on-site.

H. Roadways and Walks: Unless otherwise approved by Engineer, excavated material and materials of construction shall be so deposited, and the Work shall be so conducted, as to leave open and free for pedestrian traffic all crosswalks, and for vehicular traffic a roadway not less than 10 feet in width. All hydrants, valves, and other facilities which may require access during construction shall be kept accessible for use. During the progress of the Work, Contractor shall maintain such crosswalks, sidewalks, and roadways in satisfactory condition and the Work shall at all times be so conducted as to cause a minimum of inconvenience to the Owner. Temporary bituminous macadam shall be installed at all disturbed sidewalk areas until such time as the final restoration is performed.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ALL FILL MATERIAL

A. All fill material shall be virgin, clean inert, well graded material that is free of refuse and vegetable matter, frozen material and other objectionable material.

B. Excavated materials meeting these requirements and the requirements stipulated below for the appropriate type of fill material shall be used when approved by the Engineer. Otherwise the Contractor shall excavate, haul and place material from approved off-site sources.

C. All materials for fill shall be environmentally clean material conforming to the requirements of NYSDEC Unrestricted Use Soil Cleanup Objectives found at 6 NYCRR Part 375-6.

2.2 SOIL MATERIALS

A. Engineered Fill: Well graded granular material or bank run gravel, free from organic matter and shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
3-inch	100
1/4-inch	100
No. 40	5-50
No. 200	0-10

B. Structural Fill and Select Fill: Well graded granular material or bank run gravel, free from organic matter conforming to the requirements of NYSDOT Section 203-2.02C and shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
4-inch	100
No. 40	0-70
No. 200	0-15

1. Fines passing No. 200 shall be non-plastic

2. Particle size shall show no gap grading

C. General Fill: Soil materials for general backfill and fill shall be free of organics, clay, rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials and other deleterious matter. No more than 30 percent by weight shall pass through a No. 200 sieve except for topsoils.

D. Granular embedment: Crushed rock or pea gravel with not less than 95 percent passing a 1/2-inch sieve, not less than 95 percent retained on a No. 4 sieve and maximum 5 percent passing a No. 10 sieve.

E. Crushed stone, as specified on the drawings, shall be a naturally or artificially graded mixture of crushed gravel, crushed stone, meeting the material requirements for NYSDOT Standard Specifications, latest revision, Section 703-02, Table 703-2, size No. 1 and 2 as indicated, meeting gradation requirements of Section 703-04, Type 2.

F. Pea Gravel: Pea gravel shall consist of clean naturally rounded aggregate with a range of particles between 1/8 inch and 3/4 inch in conformance with gradation requirements of ASTM C-33. The material shall not have more than 3% passing a #8 sieve. Deleterious substance limitations and soundness shall conform to requirements of ASTM C-33.

G. Bedding Sand: Bedding Sand shall be manufactured or natural river or bank sand and shall be free of silt, clay, loam, friable or soluble materials and organic matter; graded within the following limits:

Sieve Size	Percent Passing
#4	100
#14	10-100
#50	5-90
#100	4-30
#200	0

H. Unsuitable Material: All soils not meeting the requirements of Paragraphs 2.2A. through 2.2B and all organic materials.

2.3 REMOVAL OF WATER

A. The Contractor's attention is directed to the fact that some of the work and structures may be below groundwater. Therefore, the need for an adequate and well-planned dewatering system is essential to allow excavation and concrete construction to be performed in a dry suitable environment.

B. The Contractor, at all times during construction, shall provide and maintain ample means and suitable equipment, consistent with conditions encountered, with which to promptly remove and properly dispose of all water entering excavations or other parts of the work. All excavations shall be kept dry at all times until the structures to be built therein are completed and backfilled to approximately final grades except where otherwise approved by the Engineer in writing. Concrete for structures, pipe and sanitary structures shall be placed on subgrades which are dry. Water shall be disposed of in a suitable manner so as to avoid damage to adjacent property, existing structures and all work under construction. It shall be the Contractor's responsibility to prevent flotation of any structures during construction.

C. Systems used to lower the groundwater level shall be maintained in operation continuously, twenty-four hours a day, seven days a week, until the structures are completed adequately to prevent flotation. Termination of the dewatering operation shall receive approval of the Engineer.

D. No additional compensation will be given to the Contractor because of damage from flooding caused by groundwater or surface waters rising above ground elevations.

E. The Contractor shall be responsible for obtaining and adhering to all provisions of necessary dewatering permits at no additional costs to the Owner. Groundwater shall not be permitted to be discharged into storm drains or surface waters without proper approval from regulatory agencies.

F. Dewatering system shall be installed as required to lower the groundwater level in general excavation at least 2 feet below final subgrade.

G. In order to limit the size of the area affected by dewatering, the use of deep wells shall be prohibited.

H. Prior to installing and operating any dewatering system, the Contractor shall install a series of observation wells and monitor same for a minimum period of 2 working days in order to determine the groundwater level at the time of construction. The observation wells shall be located both within and adjacent to the proposed construction site. Observation wells located within the limits of the proposed construction site shall be situated outside of the physical limits of the structures and protected from damage. Any damaged observation wells shall be replaced or repaired. During construction, the water level in the observation wells shall be measured and recorded periodically.

2.4 SHEETING, SHORING, AND BRACING

A. Wood Sheeting:

1. Temporary Work: New or used timber meeting the requirements for Douglas Fir Dense Construction grade or Southern Pine No. 2 Dense S3.

2. Permanent Work: New pressure creosoted timber or copper chrome arsenate treated wood.

B. Steel Sheeting:

1. Temporary Work: Steel conforming to ASTM A 328. Steel for soldier piles, wales and braces may be new or used and shall conform to ASTM A 36.

2. Permanent Work: New rolled steel sections of the continuous interlocking type, conforming to ASTM A 328.

C. Used materials shall be in good condition, not damaged or excessively pitted.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor shall provide Engineer with sufficient time and means to examine the areas and conditions under which excavating, filling, and grading are to be performed. Work shall not proceed until all unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 EROSION CONTROL

A. General:

1. In general, the construction procedures outlined herein shall be implemented to ensure minimum damage to the environment during construction.

2. Whenever possible, access and temporary roads shall be located and constructed to avoid environmental damage. Provisions shall be made to regulate drainage, avoid erosion and minimize damage to vegetation. Special care shall be taken to eliminate depressions that could serve as mosquito pools.

3. Where areas must be cleared for storage of materials or temporary structures, provisions shall be made for regulating drainage and controlling erosion, subject to Engineer's approval.

4. In the event of any temporary work stoppage, the Contractor shall take steps to prevent any temporary or permanent environmental damage to the area undergoing construction.

B. Control Measures:

1. Temporary measures shall be applied to control erosion and to minimize the siltation of the existing drains, streambeds and natural ponding areas. Such measures shall include but not be limited to the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, grasses, slope drains and other methods. These temporary measures shall be applied to erodible materials exposed by any activities associated with the construction of this Project.

2. Temporary measures shall be coordinated with the construction of permanent drainage facilities and other work to the extent practicable to assure economical, effective, and continuous erosion and siltation control.

3. The Contractor shall provide special care in areas with steep slopes. Disturbance of vegetation shall be kept to a minimum to maintain stability. Remove only those trees and shrubs and grasses that must be removed for construction. Protect the rest to preserve their aesthetic and erosion-control values.

4. Install erosion and sediment control practices as specified herein and according to soil conservation standards and specifications. The practices shall be maintained in effective working condition during construction and until the drainage area has been permanently stabilized.

5. Temporarily stabilize each segment of graded or otherwise disturbed land, including the sediment-control devices not otherwise stabilized by seeding and mulching or by mulching alone.

3.3 EXCAVATION

A. General:

1. Contractor shall perform all excavation required to complete the Work as shown and specified. All material excavated shall be nonclassified. It shall include all materials such as earth, sand, clay, gravel, hardpan, boulders, organic materials, decomposed rock, pavements, concrete, rubbish and all other materials within the excavation limits.

2. Excavations shall be open type, shored and braced as shown on the plans and where necessary to prevent injury to workmen and to new and existing structures or pipelines.

3. All excavations shall be made in the dry.

4. Dispose of excavated material and waste materials as specified herein under Disposal of Excavated Material.

B. Pipeline Excavation:

1. Pipe trenches shall be excavated below the pipe bottom by an amount sufficient for placement of the pipe bedding shown on the drawings and as specified. No more than 50 feet of trench may be opened in advance of pipe laying.

2. Trench width shall be minimized to greatest extent practical but shall conform to the following:

a. Sufficient to provide room for installing, jointing and inspecting piping, but in no case wider than that indicated in the Contract Drawings.

b. Enlargements at pipe joints may be made if required and approved by Engineer.

c. Sufficient for sheeting, bracing and sloping.

d. Sufficient to allow thorough compacting of granular embedment adjacent to bottom half of pipe.

e. Do not use excavating equipment which requires the trench to be excavated to excessive width.

3. At road crossings, trenching width shall be minimized by the use of sheeting, trench boxes on similar protection methods.

C. Manhole Excavation:

1. Excavation shall be made to the grades shown on the Contract Drawings and to such widths as will give suitable room for construction of the manholes, for bracing and supporting, pumping and draining. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer.

2. Excavation shall be accomplished by methods which preserve the undisturbed state of subgrade soils.

3. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Specifications. Earth shall not be plowed, scraped, or dug with machines so near to the finished subgrade as to result in excavation of, or disturbance of material below grade.

4. When excavation for foundations has reached final depths, the Engineer shall be notified and will inspect conditions. If materials and conditions are not satisfactory to the Engineer, the Engineer will issue instructions as to the procedures for correction of the unsatisfactory condition.

5. During final excavation to subgrade level, take precautions required to prevent disturbance of material. Hand excavate the final 6-in as necessary to obtain a satisfactory undisturbed bottom.

D. Unsuitable Excavation:

1. If any over excavation occurs through error of the Contractor or for the Contractor's convenience, it shall be refilled at the Contractor's expense with concrete, select fill or other material satisfactory to the Owner. The Contractor shall be held solely responsible for costs associated with characterizing, transporting and disposing the excavated material off-site in accordance with all applicable federal, state and local laws and regulations, as well as the requirements of these Contract Document.

2. If Contractor fails to properly dewater the excavation or trench, or disturbs the subgrade or otherwise fails or neglects to conduct the excavation work in a manner that provides surface of subgrade in proper condition for construction, the Contractor shall remove all disturbed material and replace it with concrete, select fill, or other approved material at his own expense. The condition of the subgrade shall meet with the approval of the Owner before any work is placed thereon.

3. If, in the opinion of the Engineer, the material, in its undisturbed natural condition, at or below the grade of the excavation indicated on the Drawings is unsuitable for foundations, or if organic or silty soil extends below excavation depth, it shall be removed to such depth and width as the Engineer may direct and be replaced with select fill or other suitable material as directed by the Engineer. Compensation will be in accordance with the Agreement or applicable unit price bid.

E. Additional Excavation:

1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material with structural fill or other material as approved by Geotechnical Engineer.

2. Removal of unsuitable material, and its replacement as directed, will be paid on basis of Contract conditions relative to changes in work.

F. Excavation for Structures:

1. Conform to elevations and dimensions shown on the drawings, within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services, other construction, and for inspection.

2. In excavating for footings and foundations, take care not to disturb the bottoms of the excavation. Excavate by hand to a final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave a solid base to receive concrete.

3. Sloping surfaces under footings and foundations, or other work where required, shall be cut in steps as indicated on the Drawings or as directed by the Engineer.

G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F. (1 degree C.).

3.4 SHEETING, SHORING AND BRACING

A. General:

1. Sheeting, shoring and bracing shall be used where necessary to prevent injury to workmen, structures, or pipe lines.

2. All municipal, county, state and federal ordinances, codes, regulations and laws shall be observed. All excavations shall be shored with the minimal protection of sheeting listed in OSHA Regulations, 29 CFR, Part 1926, Subpart P - Excavations, Trenching and Shoring.

3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

4. Unless otherwise shown, specified, or ordered, all materials used for temporary sheeting shall be removed when work is completed. Such removal shall be made in a manner not injurious to the structure or its appearance or to adjacent Work.

5. Provide permanent sheeting as shown. Cut off tops as required, but at least 2-feet below finished grade.

6. The clearances and types of the temporary sheeting, insofar as they affect the character of the finished Work, will be subject to the approval of the Engineer but the Contractor shall be responsible for the adequacy of all sheeting, shoring, bracing and other related Work.

7. Safe and satisfactory installation of the sheeting shall be the entire responsibility of the Contractor.

B. Sheeting Left in Place:

1. Steel sheet piling to be left in place (where directed by the Engineer) shall be driven straight to the lines and grades shown or directed. The piles shall penetrate into firm materials with secure interlocking throughout the entire length of the pile. Damaged piling having faulty alignment shall be pulled and replaced by new piling.

2. The type of guide structure used and method of driving steel sheet piling to be left in place shall be subject to the approval of the Engineer.

3. Contractor shall cut off piling left in place to the grades shown or ordered by the Engineer and shall remove the cut offs from the site.

4. Contractor shall thoroughly clean wales, braces and all other items to be embedded in the permanent structure, and shall make provisions that the concrete surrounding the embedded element is sound and free from air pockets or harmful inclusions. The provisions shall include the cutting of holes in the webs and flanges of wale and bracing members, and the welding of steel diaphragm waterstops perpendicular to the centerline of brace ends which are to be embedded.

5. Subsequent to removal of the inside face forms, and when removal of bracing is permitted, steel shall be cut back at least 2 inches inside the wall face and the opening patched with cement mortar. The concrete shall be thoroughly worked beneath wales and braces, around stiffeners and in any other place where voids may be formed.

C. Removal of Sheeting and Bracing:

1. Remove sheeting and bracing from excavation unless otherwise shown on the Drawings or ordered in writing by the Engineer. Removal shall be done so as to not cause injury to the Work. Removal shall be equal on both sides of excavation to ensure no unequal loads on pipe or structure. Use of vibratory extractors is prohibited.

2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete, until wall and floor framing up to and including grade level floors are in place and concrete has attained sufficient strength to withstand the soil and superimposed loads.

3.5 STRUCTURAL FILL, BACKFILL, AND COMPACTION

A. Place fill materials in the types and thicknesses as detailed on the Drawings. All backfill shall be Select Fill unless otherwise directed by the Engineer, or shown on the Drawings.

B. Fill excavations as promptly as Work permits, but not until completion of the following:

1. Acceptance by Engineer of all Work within the excavation.

2. Inspection, testing approval, and recording of locations of underground utilities, connections, branches, structures and other facilities.

3. Removal of temporary shoring and bracing, and backfilling of voids with satisfactory materials.

4. Removal of trash and debris.

C. Excavation shall be kept dry during backfilling operations. Backfills around piping and structures shall be brought up evenly on all sides.

D. All structures and pipe trenches shall be backfilled with the type of material listed below except where shown otherwise on the Contract Drawings.

Type of Backfill	Location
Select Fill	Replacement of unsuitable material removed below bottom slabs of structures and manholes, below pipe beddings, and where shown on the drawing.
Granular Embedment Material	Pipe bedding and backfill within the pipe zone. The pipe zone extends from the bottom of the trench to six (6) inches above the top of the pipe for pipes thirty (30) inches and smaller, and to twelve (12) inches above the top of the pipe for pipes greater than thirty (30) inches in diameter.
Crushed Stone	In locations shown on the drawings.
Rip Rap	In locations shown on the drawings.
Pea Gravel	In locations shown on the drawings.
Common/General Fill	In all locations not enumerated above.

E. Backfill above and adjacent to pipe shall be compacted by light weight equipment, such as "walk behind" vibratory plate compactors. Heavy self-propelled compactors shall not be used until the following criteria are met:

1. A minimum of 18 inches of compacted backfill has been placed above the top of the pipe.

2. Area to be compacted is a minimum distance of three pipe diameters away from the adjacent pipe.

3. Area to be compacted is a minimum of 10 feet from building and tank walls and riser pipes.

F. Hydro hammers or "jumping jack" hammers shall not be used above pipes until a minimum of 3 feet of backfill has been placed and compacted.

G. After approval of the subgrade by the Geotechnical Engineer, the geotextile shall be placed, where shown on the Drawings, upon the subgrade in accordance with the manufacturer's instructions and the following:

1. After acceptance of the subgrade, the fabric shall be installed prior to placement of the first course of compacted structural fill, stone or subbase.

2. Geotextile may be joined by either sewing or overlapping. Sewn seams shall be lapped a minimum of 4 inches and double sewn with nylon or polypropylene. Overlapping seams shall have a minimum overlap of 18 inches, except where placed underwater where the overlap shall be a minimum of 3 feet.

3. Fabric which is torn or damaged shall be replaced or patched. The patch shall extend 3 feet beyond the perimeter of the tear of damage.

4. Traffic or construction equipment shall not be permitted directly upon the fabric. Maintain a minimum of 8 inches loose thickness of aggregate above the stabilization fabric subject to traffic.

H. Place backfill and fill materials in layers not more than 12" in loose depth. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with 12" as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water or extraneous debris.

I. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced at the Contractor's expense.

J. Moisture Control:

1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill. Prevent ponding or other free water on surface subsequent to, or during, compaction operations.

2. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is

too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.

K. All fill shall be thoroughly and satisfactorily compacted to 95 percent of the maximum density of material used.

L. If the surface of any layer becomes contaminated by mud or unsuitable materials, the contaminated soil shall be removed.

M. Fill placement shall be suspended when wet weather prevents proper operation of compaction equipment.

N. Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to structure shall be increased at approximately the same rate on all sides of the structure.

O. No backfilling or compaction shall take place against any cast-in- place concrete footings or slabs prior to 7 days initial concrete set, or against any cast-in-place concrete walls prior to achieving the desired design strength, f'c.

P. Heavy equipment shall not be operated within 4 feet of any structure. Heavy vibratory compactors shall not be operated within 4 feet of any structure.

Q. Excavated material meeting the requirements of Select Fill shall be spread and allowed to dry until obtaining the required moisture content prior to re-use.

3.6 FIELD QUALITY CONTROL

A. Notify the Engineer at least one (1) working day in advance of all phases of filling and backfilling operations.

B. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:

1. In-place relative density:

a. Method: AASHTO T191, Sand Cone Method

AASHTO T238, Nuclear Method

C. Foundation Subbase: Perform one (1) field density test, in each compacted fill lift, for the following:

1. Each isolated spread footing.

2. Each 20 feet or less of continuous footing, but no fewer than two tests along a wall.

3. Each 2,000 sq. ft. of structural base slab and/or slabs on grade, but in no case fewer than three tests.

D. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 50 feet or less of wall length, but no fewer than two tests along a wall face.

E. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.

F. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density in accordance with ASTM D 698. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

G. Crushed stone shall be compacted with a vibratory plate compactor or vibratory rolling compactor. Three complete passes shall be made on each 8 inch thick loose layer of stone. Such passes shall overlap the adjacent previously compacted area a minimum of 20%. Density requirement for crushed stone will be considered satisfactory upon completion of compaction.

H. If the tests indicate unsatisfactory compaction, the Contractor shall provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction work shall be performed by the Contractor at no additional cost to the Owner until the specified compaction is obtained. This Work shall include complete removal of unacceptable fill areas and replacement and recompaction until acceptable fill is provided, as determined by the Engineer.

3.7 GRADING

A. Uniformly grade areas within limits of the Work, including adjacent transition areas. Smooth subgrade surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Pavements: Shape surface of areas under pavements to the line, grade and cross-section shown, with finish surface not more than 1/2 inch above or below the required subgrade elevation.

C. Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/4 inch when tested with a 10 foot straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density required.

3.8 CONTAMINATED MATERIALS STORAGE

A. Excavated material shall be placed in temporary storage or transported off-site for disposal immediately after excavation. Temporary storage areas shall be located within the property line of the Site and shall be delineated by the Contractor in its approved submittals. Storage areas shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. Each storage area shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each area.

B. Storage of excavated material outside the designated soil staging areas is prohibited without prior written approval by the Owner.

C. The following methods of storage are acceptable:

1. Stockpiles

a. Excavated materials shall be stockpiled in the areas noted in the Contractor's approved submittals. Stockpiles shall be located 10 feet or greater from property lines.

b. Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile height shall be 10 feet. Each stockpile shall be labeled with an identification number identifying the material stored within the stockpile.

c. Diversion measures shall be employed to prevent storm water run-on and run-off. A sealed geomembrane liner and cover shall be used to prevent cross-contamination of existing ground surface, precipitation from entering the stockpile and emissions and dust from escaping. The minimum thickness of the geomembrane liner shall be 40 mils and the sealed geomembrane cover shall be 20 mils. Control measures such as wetting the stockpile surfaces shall be employed to suppress dust. Only potable water shall be used for this purpose.

2. Roll-off Units

a. Roll-off units may be used for temporary storage in lieu of stockpiling the material.

b. Roll-off units used to temporarily store contaminated material shall be watertight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. Liquid which collects inside the units shall be removed and disposed off-site in accordance with all applicable federal, state and local laws and regulations.

D. Storage and handling of contaminated soil must comply with all applicable NYSDEC solid waste regulations (6 NYCRR Part 360) and hazardous waste regulations (6 NYCRR Parts 370-376).

E. Excavated soil may not be stored on-site for a period greater than 30 days from being removed from the ground.

F. Spillage shall be minimized and contained for later off-site disposal in accordance with all applicable federal, state and local regulations.

G. All materials used to protect underlying soil and adjacent areas during the soil removal and handling activities must be properly characterized and removed for proper off-site disposal in accordance with all applicable federal, state and local laws and regulations following completion of these activities. The Contactor shall obtain the Owner's approval of the waste characterization and the disposal facility prior to any waste being transported off-site.

3.9 DISPOSAL OF EXCAVATED MATERIALS

A. No excavated materials suitable for common or select fill shall be removed from the site or disposed of by the Contractor except as directed by the Owner. Materials shall be neatly piled at designated locations on-site.

B. Organic material and material which does not conform to the requirements for backfill shall be disposed of in compliance with these specifications.

C. Contractor shall not dump soil onto those areas designated as wetlands or waterways. Contractor shall not stockpile or store spoil, materials, tools or equipment on wetlands.

3.10 RESTORING AND RESURFACING EXISTING ROADWAYS AND FACILITIES

A. Pavement, gutters, curbs, walks, driveways and roadways disturbed or damaged by the Contractor's operations shall be restored or replaced by him to original or better condition.

B. After all other work has been completed in each area not to be paved, place and grade topsoil to a depth of not less than 6-inches.

3.11 ENVIRONMENTAL PROTECTION AND RESTORATION

A. See Section 01 57 19 for requirements pertaining to additional environmental controls required.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 31 10 00

DEMOLITION AND SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Site Demolition:

1. Demolition of site improvements including, but not limited to, paving, curbing, sidewalks, fencing, gates and existing building foundations.

2. Demolition of abandoned building foundations and associated utilities, in whole or in part, as shown on the Drawings.

3. Protection of site work and adjacent structures.

4. Pollution control during demolition, including noise control.

5. Removal and legal disposal of materials.

6. Dismantled items to be retained by the Owner.

7. Dismantled items to be reinstalled.

1.2 SUBMITTALS

A. Clearing Plan: Submit list of proposed operations, and identify site improvements and features to remain. Include proposed location for stockpiles.

B. Schedule: Submit for approval selective demolition schedule, including schedule and methods for maintaining existing utility service.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Use experienced workers.

1.4 PROJECT CONDITIONS

A. Immediate areas of work will not be occupied during selective demolition. The public, including children, may occupy adjacent areas.

B. No responsibility for buildings and structures to be demolished will be assumed by the Owner.

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 33 00, Submittal Procedures

B. Section 01 74 00, Cleaning and Waste Management:

PART 2 - PRODUCTS - NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

3.1 SITE CLEARING OPERATIONS

A. Protection of existing trees, vegetation, landscaping and site improvements not scheduled for clearing which might be damaged by construction activities.

B. Trimming of existing trees and vegetation as recommended by arborist for protection during construction activities.

C. Clearing and grubbing of stumps and vegetation, and removal and disposal of debris, rubbish, designated trees, and site improvements. This includes removal of tree stumps on-site from previous tree removals.

D. Topsoil stripping and stockpiling.

E. Temporary erosion control, siltation control and dust control.

F. Temporary protection of adjacent property, structures, benchmarks and monuments.

G. Temporary relocation of play structures, fencing and site improvements scheduled for reuse.

H. Watering of trees and vegetation during construction activities.

I. Removal and legal disposal of cleared materials.

3.2 DEMOLITION

A. Do not damage building elements and improvements indicated to remain. Items of salvage value, not included on schedule of salvage items to be returned to Owner, shall be removed from site. Storage or sale of items at project site is prohibited.

B. No explosives are permitted.

C. Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the

written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

D. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

E. Provide adequate protection against accidental trespassing. Secure project after work hours.

F. Restore finish of patched areas.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section includes drilling, excavation, removal and disposal of rock as necessary for the installation of the Work, and as indicated and specified herein. Contractor shall refer to the Geotechnical Report included in Appendix 1 of the Technical Specifications for rock locations and suggested removal operation.

1.2 DEFINITIONS

A. Rock: Limestone, sandstone, shale, granite, quartz, and formations of other varying mineral or aggregate composition in solid beds or masses in its original or stratified position that exceed 1 cubic yard and that cannot be excavated with one of the following:

1. A crawler tractor having a minimum draw bar pull rated at not less than 71,000 pounds (Caterpillar D9N or equivalent) and occupying an original volume of at least 1 cubic yards or more.

2. A backhoe having a break out force rated at not less than 44,000 pounds (Caterpillar 235D or equivalent) and occupying an original volume of at least 1 cubic yards.

B. Rock Excavation: Removal of rock by means of drilling (exclusive of pile installation), or use of pneumatic tools or expansive chemical agents. Removal of materials which, in the opinion of the Engineer, can be loosened and excavated by mechanical means (ripping, etc.) including frozen materials, soft laminated shale or hardpan, pavements, curbs and similar materials shall be classified as earth excavation with the exception of rock face scaling. Contractor shall provide / include the following within Rock Excavation costs:

1. Survey of excavation(s) shall be provided by the Contractor. On-site Engineer will be responsible for survey confirmation and accuracy.

2. Contractor shall not proceed with the excavation of material until cross sections have been taken and the Engineer has classified (verified) the materials as common excavation or rock excavation.

3. Failure on the part of the Contractor to uncover such material, notify the Engineer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Engineer for the areas of work in which such deposits occur.

C. Unauthorized Excavation: Removal of any material beyond horizontal and vertical limits indicated on the Drawings or as specified herein, without the prior approval of the Engineer.

D. Scaling: Scaling shall be considered the removal of loose and broken rock from the face of rock cuts by mechanical means. Scaling shall be included in Rock Excavation item as defined above.

E. Pile Installation: Rock drilling, removal and disposal specifically for the installation of piles will not be considered rock removal.

1.3 REGULATORY REQUIREMENTS

A. Comply with the applicable requirements of the Code of Federal Regulations Title 29 - Labor, Part 1926 Safety and Health Regulations for Construction (OSHA).

1.4 SUBMITTALS

A. General:

1. Submit Specialty Contractors' qualifications, to the Engineer for approval.

2. Submit work plans, site safety plans, proposed equipment, and a detailed outline of intended rock removal procedures and any other information listed in this specification to the Engineer for approval. This submittal shall not relieve the Contractor of complete responsibility for the successful performance of the method(s) used.

B. Site Safety Plan:

1. Site safety shall be coordinated through the Contractor's office. A written safety plan shall be developed and distributed to all subcontractors, the Owner and the Engineer.

C. Certifications/Licenses:

1. One (1) copy of each certificate, license, permit, and proof of insurance required by this specification shall be submitted to the Engineer after award

of contract and prior to commencement of work.

1.5 PROJECT/SITE CONDITIONS

A. Existing Conditions: Existing physical conditions as defined for design purposes are noted on the Drawings and are described in the Information Available to Bidders section of the Contract Documents.

1.6 MAINTENANCE

A. Any and all damage caused by the Rock Removal operations shall be repaired or replaced to the property Owner's and Engineer's satisfaction at the expense of the Contractor.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 ROCK REMOVAL

A. Remove rock as indicated by the Drawings and as necessary for the installation of the Work. Provide sufficient clearance, within the limits specified, for the proper execution of the Work.

B. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

1. 24 inches outside of concrete forms other than at footings.

2. 12 inches outside of concrete forms at footings.

3. 6 inches outside of minimum required dimensions of concrete cast against grade.

4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

5. 6 inches beneath bottom of concrete slabs on grade.

6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

7. 12 inches outside of stone construction entrance limits as shown on plans.

C. Fill areas of over-excavated rock to the proposed subgrade elevations as required

by Drawings with selected fill in accordance with Section "Trenching and Backfilling" or Section "Earthwork" Over-excavation beneath foundations shall be filled with footing concrete (f'c = concrete compressive= 3000 psi minimum).

D. All rock slopes shall be thoroughly scaled to the satisfaction of the Engineer. Scaled rock slopes shall be stable and free from possible hazards of falling rocks or rock slides that endanger public or worker safety. If such conditions exist after proper scaling, remedial treatment shall be provided by the Contractor at no additional expense to the Owner. In the event that natural conditions such as wedge instability are encountered, remedial treatment shall be provided as necessary to stabilize the rock slope. Such treatment may include, but is not necessarily limited to, rock bolting or grouting, shoring, or shotcreting. Large scale ripping shall not be permitted within 10 feet of any final rock slope prior to presplitting or line drilling.

E. Blasting will not be permitted.

3.2 EXCAVATION TOLERANCES

A. Rock removal limits shall include all materials defined as rock whether removal is accomplished by mechanical means (ripping, etc.) or by drilling.

PART 4 - MEASUREMENT AND PAYMENT

4..1 MEASUREMENT

A. The quantity of Rock Removal to be measured for payment shall be the volume of rock from between approved vertical planes that are established as defined herein and extending from the subgrade of the trench or excavation to the rock surface, measured in place, removed and disposed of away from the site of the work.

ITEM	DESCRIPTION	UNIT
O	Rock Removal	Cubic Yard

4.2 PAYMENT

A. The contract price for Rock Removal shall be the unit price bid per cubic yard and shall cover the cost of all labor, materials, plant, equipment and insurance required and necessary to remove and dispose of all rock from within the limits of the rock excavation payment lines, together with all work incidental thereto, all in accordance with the Plans and Specifications and as directed by the Engineer.

B. No payment will be made for rock removed beyond the payment limits that results from over breakage of rock.

+ + END OF SECTION + +

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes the excavation of trenching, backfilling, compacting, dewatering, excavation support and disposal, as shown on the Contract Drawings, and as herein specified.

B. The Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 REFERENCES

A. Standards referenced in this Section shall be the latest edition of the following standards:

1. Standard Specifications, Construction and Materials, New York State Department of Transportation, Office of Engineering.

2. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).

3. American Society for Testing and Materials (ASTM).

B. The Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having jurisdiction, including the State.

C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications in accordance with Section Quality Requirements.

1.3 QUALITY ASSURANCE

A. Notify the Engineer of any unexpected subsurface condition.

B. Protect excavations by shoring, bracing, sheet piling, or by other methods, as required to ensure the stability of the excavation. Comply with OSHA requirements.

C. Underpin or otherwise support structures adjacent to the excavation, which may be damaged by the excavation. This includes service lines.

D. Protection of Existing Utilities:

1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.

2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.

3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.

E. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified.

F. Repair any damaged utilities as acceptable to the Owner, Engineer, and utility company at no additional cost to the Owner.

G. Contractor shall comply with maintenance and protection requirements as approved by the authority having jurisdiction.

H. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights, if required.

2. Operate warning lights as recommended by authorities having jurisdiction.

3. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

4. Perform excavation within drip-line of trees to remain by hand, and protect the root system from damage or dry out to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint cut roots of 1-inch diameter and larger with emulsified asphalt tree paint.

1.4 SUBMITTALS

A. Samples:

1. The Contractor shall furnish representative earth materials to the testing laboratory for analysis and report, as directed by the Engineer, or as outlined in the specifications.

B. Test Results:

1. The testing laboratory shall submit written reports of all tests, investigations,

findings, and recommendations to the Contractor and the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Pipe Zone Bedding: Select mixture of graded crushed stone, free from organic, frozen or other deleterious materials, conforming to the requirements of NYSDOT Section 703-02 and meeting the following gradation requirements (NYSDOT Size 2):

SIEVE	PERCENT PASSING
1-1/2"	100
1"	90 – 100
1/2"	0 – 15

B. Pipe Zone Backfill: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of NYSDOT Section 304 and meeting the following gradation requirements (NYSDOT Subbase Type 4):

SIEVE	PERCENT PASSING
2"	100
1/4"	30 – 65
No. 40	5 – 40
No. 200	0 – 10

C. Suitable Material: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of NYSDOT 203-2.02C and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
4"	100
No. 40	0 – 70
No. 200	0 – 15

1. Run-of-trench material, meeting the above criteria, shall be considered suitable material and shall be used for trench backfill only after tested in accordance with Section Quality Requirements and approved by the Engineer.

The Contractor shall pay for all additional testing required to determine the conformance of run-of-trench material, if at any time during the Work this material appears to be in non-conformance in the opinion of the Engineer.

PART 3 – EXECUTION

3.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. General:

1. Sufficient size samples shall be obtained from the potential borrow source to allow completion of tests listed in paragraph B below. Samples may be obtained from test borings, test pits, or from borrow pit faces provided that surficial dry or wet soil is removed to expose undisturbed earth. Tests listed below shall be performed on each sample obtained. A minimum of 3 representative samples from each potential borrow source shall be furnished to the testing laboratory for prequalification testing. Test data shall be provided to the Engineer a minimum of 2 weeks prior to construction for approval of borrow source. Three test reports completed within three months prior to construction may be submitted for commercial earth borrow sources or suppliers of stone products (crushed stone or graded stone products) in lieu of prequalification tests as approved by the Engineer.

B. Material Tests:

1. Particle Size Analysis:

a. Method: ASTM D422.

b. Number of Tests: One (1) per sample; three (3) per potential source.

c. Acceptance Criteria: Gradation within specified limits.

2. Maximum Density Determination:

a. Method: ASTM D1557 - Modified Proctor.

b. Number of Tests: One (1) per sample; three (3) per potential source.

3. Re-establish gradation and maximum density of fill material if source is changed during construction.

3.2 PREPARATION

A. Establish required lines, levels, contours, and datum.
B. Maintain benchmarks and other elevation control points; re-establish if disturbed or

destroyed at no additional cost to the Owner.

C. Establish location and extent of existing utilities prior to commencement of excavation.

3.3 EXCAVATION

A. All excavation shall be made to such depth as required and of the width shown on the Drawings to provide suitable room for building the structures and laying the pipe(s) they are to contain and for sheeting, shoring, pumping and draining as necessary, and for removing peat, silt, or any other materials which the Engineer may deem unsuitable. Hand trench excavation may be required to protect existing utilities and structures.

B. Trench excavation for pipes shall be made by open cut to accommodate the pipe or structure at the depths indicated on the Drawings. Excavation shall be made to such a depth and to the width indicated on the Drawings so as to allow a minimum of 8 inches of pipe zone bedding to be placed beneath the bottom of all structures and barrels, bells or couplings of all pipes installed unless otherwise specified on the Drawings.

C. The bottom of the trench shall be accurately graded to provide a uniform layer of bedding material as required for each section of pipe. Trim and shape trench bottoms and leave free of irregularities, lumps, and projections.

D. Stockpile excavated subsoil for reuse where directed or approved.

E. Over excavation/undercut: If, in the opinion of the Engineer, existing material below the trench grade is unsuitable for properly placing bedding material and laying pipe, the Contractor shall excavate and remove the unsuitable material and replace the same with an approved pipe zone bedding material properly compacted.

F. Stability of Excavation: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavation in safe condition until completion of backfilling.

G. Removal of materials beyond the indicated subgrade elevations, without authorization by the Engineer, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.

3.4 DEWATERING

A. The Contractor shall remove all water from the excavation promptly and continuously throughout the progress of the work and shall keep the excavation dry at all times until the work is completed and excavation is backfilled or have sufficient weight to resist uplift pressures. Groundwater levels shall be depressed to a minimum of 2 feet below excavation subgrade. No pipe or structure is to be laid in water and water shall not be

allowed to rise on or flow over any pipe or structure until such time as approved by the Engineer.

B. Provide a suitable point of discharge from dewatering operations shall be conveyed in a non-erosive manner satisfactory to the Engineer.

C. Precautions shall be taken to protect uncompleted work from flooding during storms or from other causes. All pipe lines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected.

3.5 BEDDING AND BACKFILLING

A. All pipe trenches backfill (pipe zone bedding, pipe zone backfill and trench backfill) shall be compacted by tamping or rolling to achieve a minimum dry density of 90 percent of the modified Proctor maximum dry density of the material used (ASTM D1557). Backfill in pipe trenches to be covered with pavement shall be compacted to a minimum of 95 percent of modified Proctor maximum dry density. Backfill materials shall be placed with water content within plus or minus 4 percent of optimum moisture content per the modified Proctor method (ASTM D1557). Any water used for compaction shall be provided by the Contractor at his own expense. The Contractor is responsible for the repair of any trench settlement at no expense to the owner.

B. Bedding and backfilling shall be accomplished in three stages unless otherwise specified on the Contract Drawings. The first stage shall involve placement of pipe zone bedding as a layer(s) of selected material required to support, or to stabilize unsound or unsatisfactory foundation conditions. The second stage shall involve placement of pipe zone backfill from the top of the bedding material up to 1 foot above the pipe. The third stage involves the placement of trench backfill in the remainder of the trench up to the surface of the ground or the bottom of any special surface treatment subgrade elevation.

C. The bedding material shall be placed in the trench after the trench has been excavated a minimum of 8 inches below the bell of the pipe to permit the placing of not less than 8 inches of bedding material unless otherwise specified on the Drawings. Where, in the opinion of the Engineer, more than 8 inches of bedding material shall be required, the excavation shall be performed and bedding placed to the depth ordered by the Engineer.

D. Provide uniform bearing and support for each section of pipe at every point along the entire length except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.

E. The bedding material shall be placed to the full width of trench. The bedding material shall be placed in loose lifts not exceeding 6 inches to the elevation shown on the Drawings or directed by the Engineer. The bedding material shall be tamped and

compacted to form a firm and even bearing surface.

F. Pipe zone backfill shall be placed to the elevation shown on the Drawings in loose lifts not-to-exceed 6 inches in thickness, before compaction. The backfill shall be placed on both sides of the pipe at the same time and to approximately the same elevation. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense. Each layer shall be thoroughly compacted by hand-tamping or mechanical means being careful not to damage the pipe. When the pipe zone backfill reaches 1 foot over the top of the pipe, the entire surface shall be compacted by mechanical means.

G. The remainder, if any, of the trench above the pipe zone backfill shall be backfilled with suitable material in loose lifts not exceeding 6 inches in thickness before compaction. Each layer shall be thoroughly compacted by mechanical means.

3.6 BACKFILLING AROUND STRUCTURES

A. The Contractor shall not place backfill against any structure without obtaining the approval of the Engineer. No dumping shall be allowed where materials would flow against or around such structures. Backfill material shall be deposited in horizontal layers not exceeding 6 inches in loose thickness or as shown on the Drawings and thoroughly compacted by hand or by mechanical means to the satisfaction of the Engineer.

3.7 SUSPENSION OF WORK

A. Whenever the work is suspended, excavations shall be protected and the roadways, if any, left unobstructed. Within or adjacent to private property, material shall be stored at such locations as will not unduly interfere with traffic of any nature and in no case shall materials be stored in locations which will cause damage to existing improvements.

3.8 DISPOSAL OF MATERIAL

A. Excess and unsuitable materials shall be disposed of by the Contractor on the site in an area approved by the Engineer or legally disposed of off- site at the Contractor’s expense.

3.9 FIELD QUALITY CONTROL

A. Notify the Engineer at least 3 working days in advance of all phases of filling and backfilling operations.

B. In-place density testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:

1. In-place relative density:

a. Method: AASHTO T238, Nuclear Method.

C. Perform initial density testing to verify that contractors proposed compaction effort will obtain the minimum required densities.

D. In-place density tests on trench backfills shall be provided for every 500 cubic yards of fill and in vertical lifts not exceeding 2 feet and at least once daily.

E. One particle size analysis (ASTM D422) and one modified Proctor compaction test (ASTM D1557) shall be competed for every 5,000 cubic yards of material placed.

F. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.

G. Acceptance Criteria: The criteria for acceptability of in-place fill shall be in-situ dry density and moisture content. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 31 25 00

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Erosion control shall include all work, materials and measures necessary to control soil erosion and sediment control resulting from construction operations, prevent flow of sediment from the construction site, and contain construction materials (including excavation and backfill) within protected working areas. In general, the work under this section shall include, but not be limited to, the work shown on the Soil Erosion and Sediment Control Plans and Details.

B. All Best Management Practices (BMPs) indicated in the Erosion and Sediment Control Plan (ESC) must be inspected and maintained regularly. Inspections are required either (1) at least once every 7 days or (2) at least once every 14 days and within 24 hours of the end of a rain event of 1/4-inch or more. The ESC plan must also be updated as site conditions and BMPs change. Keep records of maintenance activities and any ESC modifications for review during inspection.

1.2 QUALITY ASSURANCE

A. The contractor shall comply with the requirements of the NYSDEC as they relate to erosion control.

1.3 SUBMITTALS

A. Provide sample log, checklist, inspection report, or similar document that demonstrates periodic inspection of the implemented measures which must include sample dates, inspection frequency (at least monthly, year-round), & at least 3-inspections equally spaced over the site work period, description of any corrective action taken.

B. Provide date-stamped photos which show the implemented measures and any corrective action that was taken.

C. Describe what action was taken to effectively implement the ESC plan and maintain the erosion and sedimentation control measures.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Proper treatment and disposal of water from dewatering operations shall, at a minimum, require the use of a sedimentation/filtration system as necessary to remove suspended matter and other possible contaminants such as spilled fuel, lubricants, etc.

B. The design and operation of settling basins and/or filters shall be sufficient to protect the environment in accordance with all pertinent NYSDEC regulations. It shall be the responsibility of the Contractor to maintain compliance at all times during dewatering operations. In addition, care shall be taken not to damage or kill vegetation by excessive water discharge or by silt accumulation in the discharge area.

C. Settling basins, plastic filter fabrics, hay bales or other erosion and sediment control measures approved by the NYSDEC and as specified and shown on the Contract Plans shall be used where necessary to protect vegetation, wetlands and wetlands buffer zones and to prevent sediment from either surface runoff or the dewatering operations from entering catch basins, surface waters, etc.

D. All soil erosion and sediment control practices are to be installed prior to any major soil disturbance and maintained until permanent protection is established.

E. Traffic control standards require the installation of a 50-foot by 25-foot by 1-foot pad of 3-inch stone immediately after initial site disturbance. Said pad shall be underlain with a suitable synthetic filter fabric. The pad shall be maintained in a condition which will prevent tracking or flowing of sediment onto roadways and rights-of-way. This may require periodic top dressing with additional stone or additional length as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately.

F. Upon completion of construction activities, the area used for the tracking pad shall be returned to elevations and conditions which existed prior to start of construction.

G. The Contractor shall take necessary measures to maintain dust control. Dirt haul roads shall be sprinkled with water or given a surface of crushed stone or wood chips as required. Vehicles shall be cleaned, as necessary, prior to using public streets. Paved roads shall be sprinkled with water.

H. All soil erosion and sediment control devices shall be located in the field as shown on the drawing or at the direction of the Engineer. The contract drawings are not intended to show the location and details for all such devices but are to be used as a reasonable guide.

I. Any changes to the approved soil erosion and sediment control plans will require the submission of soil erosion and sediment control plans to the Engineer nd the NYSDEC for re-approval. The revised plans must meet all current State soil erosion and sediment control practices. No extension of the Contract time will be given to the Contractor should resubmission be required.

J. Contractor shall obtain all required permits.

K. Upon completion of construction work and after final grading and when permanent stabilization has been established, the bales and silt fences shall be removed by the Contractor. However, no soil erosion devices shall be removed without written permission of the Engineer.

L. All excess excavated material, except for topsoil, shall be removed from the site by the Contractor in accordance with the Contract Documents or as ordered by the Engineer.

M. Conduit outlets and catch basin inlets must be protected prior to start of construction.

N. The Contractor shall provide a detailed sequence of construction operations for review and submittal to the Engineer.

O. The Contractor shall meet the Engineer on-site to define those areas which will require soil erosion and sediment control facilities, discuss their construction.

P. All soil erosion and sediment control practices shall be left in place and maintained, including silt and sediment removal, until construction is completed, area is stabilized and the Engineer so directs.

Q. All dewatering operations must discharge directly into a sediment trap. Sediment filters shall be installed in accordance with the drawings and the details of design and construction shall be prepared and submitted by the Contractor to the Engineer and Owner for review.

R. The Contractor shall restrict his operations to the areas of construction as shown on the Contract Drawings. Any encroachment outside the areas of construction shall be the Contractor's responsibility and he shall assume all costs for repairing any damage caused by his operations.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Soil Erosion and sediment control will be measured for payment at the unit costs listed below to include acceptably placed measures for the construction shown on the plans or directed by the Engineer.

ITEM #	DESCRIPTION	UNIT
A	Soil Erosion and Sediment Control	LS

4.2 PAYMENT

A. The cost of all labor, materials, equipment and insurance required and necessary to perform all work specified herein, or as ordered, shall be deemed included in the lump sum price bid for "Soil Erosion and Sediment Control." Payment for the lump sum item shall be made in proportion to the percentage of contract completion.

+ + END OF SECTION + +

SECTION 31 25 13

EROSION CONTROL MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Under this section, the Contractor shall provide all labor, equipment and material necessary to furnish and install erosion control materials as shown on the plans, as specified and as directed by the Engineer.

B. General:

1. Erosion control materials shall be installed on sideslopes to provide soil erosion resistance, as shown on the Plans and/or as directed by the Engineer.

2. Erosion control materials shall be installed in seeded drainage channels, swales and sideslopes to provide permanent soil erosion resistance and vegetation reinforcement, as shown on the Plans and/or as directed by the Engineer.

C. Related Work Specified Elsewhere:

1. Section 31 25 00, Soil Erosion and Sediment Control.

2. Section 31 00 00, Earthwork .

1.2 QUALITY ASSURANCE

A. The manufacturer of the erosion control materials shall be a specialist in the production of the specified materials and the proposed materials shall be a standard product of their manufacture.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with the General Contract Conditions.

B. Submittal shall include, but not be limited to, manufacturer’s data, specifications, samples, installation instructions and a list of previous installations identifying the name of the owner, the project, Engineer (with telephone number and contact name), quantity of material furnished and its intended purpose.

C. The Contractor shall furnish a notarized affidavit signed by an authorized representative of the manufacturer certifying that the proposed materials comply with the requirements specified herein and are suitable for the intended purpose.

D. No material shall be shipped to the Project site until the affidavit is submitted to and approved by the Engineer.

PART 2 - PRODUCTS

2.1 PERMANENT EROSION CONTROL FABRIC

A. The composite turf reinforcement mat (C-TRM) shall be a machine produced mat of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent 3-dimensional netting structure.

B. The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between three super heavy-duty UV stabilized nettings with 0.50 x 0.50-inch (1.27 x 1.27 cm) openings. The middle, dramatically corrugated (crimped) netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50-inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent 3-dimensional structure.

All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2 to 5 inches [5 to 12.5 cm] from the edge) as an overlap guide for adjacent mats.

C. The composite turf reinforcement mat shall be the North American Green P550, or equivalent. The P550 permanent composite turf reinforcement mat shall have the following physical properties:

Material Content

Matrix 100% UV Stabilized Polypropylene Fibers (0.50 lbs/yd^2) (0.27 kg/m^2)

Netting Top and bottom - Ultra Heavy UV Stabilized Polypropylene - (24 lb/1,000 ft^2 [11.7 kg/100m^2] approximate weight)

Mid - Ultra Heavy UV Stabilized Corrugated (24 lb/1,000 ft^2 [11.7 kg/100m^2] approximate weight)

Thread Black UV Stabilized Polypropylene

Physical Specifications (per roll)

	English	Metric
Width	6.50 ft	2.00 m
Length	55.50 ft	16.90 m
Weight	52 lbs ± 10%	23.59 kg
Area	40 yd^2	33.40 m^2
Stitch Spacing	1.50 in	3.81 cm

D. Erosion control fabric shall be secured in place using heavy duty metal staples. The metal staples shall be U-shaped, a minimum of 12 inches long (each leg) and shall be fabricated from 9 gauge or greater diameter metal wire. The metal staples shall be furnished by the manufacturer of the erosion control fabric and shall be suitable for the installed product and consistent with the manufacturer's recommendations.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Each roll of erosion control material delivered to the site shall be labeled by the manufacturer identifying the manufacturer's name, product identification, roll dimension and direction for unrolling. Each roll of erosion control material shall be supplied wrapped in a relatively watertight and opaque protective cover.

B. All erosion control material shall be properly stored to protect the materials from ultraviolet degradation, precipitation or other inundation, mud, dirt, dust, puncture, cutting, extreme heat caused by direct sunlight or any other damaging or deleterious conditions.

C. Materials which are damaged during shipment, storage, handling or installation shall be rejected, removed from the job site and replaced at no additional cost to the Owner. The Contractor shall take special care to ensure that the integrity of the protective wrapping on each roll is maintained until the time of installation.

PART 3 - EXECUTION

3.1 GENERAL

A. The erosion control materials shall be installed over the prepared seedbed which has been constructed in accordance with the requirements of these specifications.

B. Prior to the placement of the erosion control materials in an area, the Contractor and the Engineer shall examine the prepared seedbed to ensure that it is smooth, stable, firm, evenly graded, free of protrusions, sharp stones, vehicle imprints or other damaging objects, properly and evenly seeded and free of erosion. The Contractor shall immediately repair any damage or defect in the prepared seedbed, including reseeding if necessary, prior to the installation of the erosion control materials.

C. The Contractor shall handle and install the erosion control materials in such a manner to ensure that the material is not damaged in any way.

D. The protective wrapping on each roll shall not be removed sooner than one hour prior to unrolling. Unused portions of rolls, which are not used in the same day that they are unwrapped, shall be rewrapped and properly stored. Unused portions of rolls which are shorter than 33% of the manufactured roll length shall be discarded unless specifically approved by the Engineer for a particular application.

E. In the presence of wind, the erosion control material shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain in place until the installation of the erosion control material is completed. The sandbags shall not be left in place, incorporated into the work, or their contents deposited on the work.

F. The erosion control materials shall be cut using approved cutting instruments as recommended by the manufacturer. The method of cutting shall result in a neat, clean, controlled cut which does not cause pulling or unraveling of the material components.

G. The erosion control materials shall be installed on the prepared seedbed within 36 hours of the placement of the seed and landscaping materials.

H. Apply erosion control materials with the length of roll laid parallel to the flow of the water in swales and channels or along the direction of slope for crown and sideslope areas.

I. Sideslope Installation:

1. The erosion control fabric shall be installed on the sideslope areas in accordance with the manufacturer's recommendations as specified and as directed by the Engineer.

2. The erosion control fabric shall be installed vertically downslope in the direction of water flow.

3. Anchor fabrics at top of slope in a 6-inch by 6-inch anchor trench, staple fabric in anchor trench on 3 feet centers. Backfill, compact and hand reseed trench areas.

4. Overlap fabric edges at least 3 inches and secure with staple at least 3 feet on centers.

5. Do not pull the erosion control fabric taut during installation. The erosion control fabric must be in intimate contact with the underlying soil surface. If

trampolining is experienced, install additional staples to secure the fabric to the soil.

6. Staple the erosion control fabric to the underlying soil using a uniform stapling pattern which will provide a staple (field) density of at least two staples per square yard.

7. Install check slots every 50 feet by placing a fold at least 8 inches vertically into the soil. Staple the fabric in the check slot on 3 feet centers and at each edge. Backfill, compact and hand seed the check slots.

8. Overlap successive lengths of erosion control fabric at least 1-foot shingle style, with upslope layer on top. Staple overlapped area on 1-foot centers.

9. Anchor the downslope ends of the fabric in an anchor slot at least 8 inches deep. Secure the fabric in the anchor slot with staples 3 feet on center and at each edge. Backfill, compact and hand seed the anchor slot.

J. The Contractor shall exercise extreme care during the placement and installation of the erosion control materials so as to minimize the disturbance to the prepared seedbed. The Contractor shall repair any damage to the prepared seedbed to the satisfaction of the Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 31 40 00

SHORING AND UNDERPINING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment, and Design of bracing, shoring, and underpinning. Selection of construction sequence. Temporary bracing of the structure or portions of the structure as required to prevent the structure from becoming unsafe during construction. Temporary shoring of portions of the structure as required to prevent the structure from becoming unsafe during construction. Temporary shoring of excavations. Construction and removal of posts, timbers, lagging, braces, etc. required in connection with bracing, shoring, and underpinning the structure during construction. Excavation, concrete placement and backfilling required in connection with underpinning

2. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.

1.2 REFERENCES

A. Standards referenced in this Section are General:

The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

B. State of New York – New York State Department of Transportation (NYSDOT): Standard Specifications.

1.3 QUALITY ASSURANCE

A. Design calculations and Shop Drawings of proposed bracing, shoring, and underpinning of the structure shall be prepared, stamped, and signed by a Structural Engineer registered in the State of New York.

1.4 **SUBMITTALS**

A. The Contractor shall submit Shop Drawings indicating layout, member sizes, connection details and construction sequence for bracing, shoring and underpinning. No work related to bracing, shoring or underpinning shall take place until the Engineer has reviewed the Shop Drawings.

B. The Contractor shall also submit Design calculations of bracing, shoring and underpinning showing member stresses and connections due to imposed loads.

PART 1 - PRODUCTS

2.1 MATERIALS

A. MATERIALS FOR SHORING AND BRACING

1. Materials for shoring and bracing shall be undamaged, high quality materials.

B. CONCRETE FOR UNDERPINNING

1. Concrete for underpinning shall meet the requirements of Division 03 Section “Cast-in-Place Concrete".

PART 3 -EXECUTION

3.1 CONSTRUCTION

A. Construction of bracing, shoring and underpinning shall be in accordance with the reviewed Shop Drawings prepared by the Subcontractor's Engineer.

B. The Contractor shall hire the Engineer responsible for the design of bracing, shoring and underpinning and inspection of the work as detailed on the bracing, shoring, and underpinning Shop Drawings, prior to sawcutting or removing portions of the structure.

C. Excavations for underpinning the foundations shall be inspected by the Geotechnical Engineer prior to placement of concrete.

D. Remove surplus excavated materials from site.

3.2 REMOVAL OF BRACING AND SHORING

A. Bracing and shoring shall not be removed until the new members have acquired

sufficient strength to support their weight and the loads superimposed thereon safely. In no case may bracing or shoring be removed until the time and sequence has been approved by the Engineer responsible for bracing and shoring and reviewed by the University.

B. In general, bracing and shoring of concrete shall remain in place for at least ten days, when they may be removed provided the concrete is sufficiently hard and will not be injured.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 32 01 00

PAVEMENT SAWCUTTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General Agreement and Supplementary Conditions and Division 1 - General Requirements, apply to the work of this Section.

1.2 DESCRIPTION

A. Provide all labor, materials and equipment necessary for sawcutting pavement.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 METHOD

A. The existing pavement shall be saw cut with a straight saw cut edge at the locations and limits shown on the plans or as directed by the Engineer.

B. Sawcutting shall be done to the satisfaction of the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Sawcutting will be measured for payment by linear foot acceptably placed within the lines and allowable tolerances shown on the plans or directed by the Engineer.

ITEM #	DESCRIPTION	UNIT
S	Pavement Sawcutting	L.F.

4.2 PAYMENT

A. Payment will be at the contract unit price per linear foot which shall include all cost of furnishing and placing materials and labor and equipment required to complete the work as specified herein and shown on the contract drawings. No payment will be made for sawcutting outside the required limits and allowable tolerance.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 32 12 16

ASPHALT PAVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide hot mix-hot laid bituminous paving as shown and specified. In addition, any existing pavement damaged by the Contractor outside the removal limits shown on the Drawings shall be removed and replaced, as directed by the Engineer at no additional cost to the Owner.

2. The Contractor shall furnish all labor, materials and equipment necessary for saw cutting, installing and removing and disposing of temporary pavement, preparing the subgrade; and constructing a bituminous pavement. The Work includes pavements comprised of one or more of the following:

   a. Base course.

   b. Tack coats.

   c. Top course.

3. In order to prevent damage to the permanent pavement by the Contractor's operations, all permanent pavement materials, including the aggregate base course, shall not be installed until approved in writing by the Engineer. The finished course of paving shall not be installed until all buildings, structures, equipment, piping and outside facilities are substantially completed and at a time approved by the Engineer.

B. Related Work Specified Elsewhere:

1. Section 02 40 00, Demolition, Removals and Modifications.

2. Section 31 00 00, Earthwork.

1.2 QUALITY ASSURANCE

A. Plant Inspection: All bituminous mixes will be subject to inspection, testing and approval by the Owner. The Contractor and suppliers shall furnish all necessary assistance and cooperation.

B. Laboratory approval of the sources of supply of the fine aggregates, coarse aggregates, mineral filler, bituminous materials, liquefiers and any other materials used in the mix shall be submitted by the Contractor for approval. No delivery or mixed materials shall be made from any bituminous mixing plant until such approval is obtained.

C. Testing Services:

1. General: Testing of materials and of compaction requirements for compliance with technical requirements of the Specifications shall be the duty of the testing laboratory provided by the Contractor.

2. Testing Services: The testing laboratory will:

a. Test the Contractor's proposed materials in the laboratory and field for compliance with the Specifications.

b. Perform field density tests to assure that the specified compaction of surface and base course materials has been obtained.

c. Report all test results to the Engineer, and the Contractor.

3. Authority and Duties of Testing Laboratory: Technicians representing the testing laboratory will inspect the materials in the field and perform compaction tests, and will report their findings to the Engineer and the Contractor. When the materials furnished or work performed by the Contractor fails to fulfill Specifications requirements, the technician will direct the attention of the Engineer and the Contractor to such failure.

a. The technician will not act as foreman or perform other duties for the Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor will it obligate the Engineer for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve or accept any portion of the Work.

4. Responsibilities and Duties of Contractor: The use of testing services shall in no way relieve the Contractor of his responsibility to furnish materials and construction in full compliance with the Drawings and Specifications. To facilitate testing services, the Contractor shall:

a. Secure and deliver to the Engineer and the testing laboratory representative samples of the materials he proposes to use and which are required to be tested.

b. Furnish such casual labor as is necessary to obtain and handle samples at the project or at other sources of material.

c. Advise the testing laboratory and Engineer sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

D. Reference Standards: Comply with the applicable provisions unless otherwise shown or specified.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval job mix formula proposed, giving complete data on materials, including source, location, percentages, temperatures, date of last testing, and all other pertinent data.

B. Submittals: Furnish certificate for approval, stating bedding course of well graded sand conforms to ASTM C33.

Furnish certificate for approval, stating the base course of crushed stone conforms to ASTM 2940, or approved equal.

1.4 JOB CONDITIONS

A. Weather Limitations:

1. Permanent paving materials, including the aggregate base course, shall be placed only when the air temperature is 40 degrees Fahrenheit and rising or warmer and the surface on which the paving is to be laid is 40 degrees Fahrenheit or higher. All temperatures are to be measured in the shade.

2. Bituminous pavement for temporary access roads, staging area and other temporary uses, that are not and will not become part of a permanent pavement, will not be subject to the above regulations in regard to weather limitations. No pavement, however, shall be laid on a frozen subgrade.

B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope for each course during construction operations.

PART 2 - PRODUCTS

2.1 PAVEMENT THICKNESS

A. In-place compacted material thickness shall not be less than shown on the Contract Drawings. Temporary pavement shall be 4-inch minimum thickness.

2.2 MATERIALS

A. Materials shall conform to the following:

1. Subgrade shall be virgin material or select fill conforming to the requirements of Section 31 00 00, Earthwork.

2. Base Courses:

a. As indicated on contract drawings.

3. Pavement:

a. Provide a wearing surface for permanent pavement, consisting of a top course. Top course shall be as indicated on Contract Drawings..

4. Tack Coat: Tack coat shall be an asphalt emulsion conforming to County Standard Material Specification M5 Bituminous Materials, Material Designation RS-1.

PART 3 - EXECUTION

3.1 GENERAL

A. The installation of all pavement materials shall be performed by experienced personnel.

B. Preparing the mixtures, paving equipment, placing the mixes, and compacting the mixes shall be in accordance with the Specifications.

1. Preparing the mixtures include the plant equipment, stockpiling, heating, aggregate processing, mixing of aggregate and bituminous material, and transportation to job site.

2. Paving equipment includes bituminous pavers, rolling equipment and hand tools.

3. Placing the mixes includes paver placing, hand placing, spreading, tamping and jointing.

4. Compacting the mixes includes breakdown rolling, second rolling and finish rolling.

C. Regardless of the type of pavement restoration involved, the Contractor shall insure that all castings are set flush with the final surface. The Contractor is advised that there shall be no placement of bituminous concrete top course until:

1. All curbs, gutter aprons, driveway aprons, surface inlets, catch basins, and manholes have been constructed to their final elevation.

2. All defective areas of the binder course have been repaired.

D. Provide final surfaces of uniform texture, conforming to required grades and cross sections.

E. Repair holes from test specimens as specified for patching defective work.

3.2 SUBGRADE PREPARATION

A. Permanent Pavement: Preparation of the permanent pavement subgrade including compaction shall be completed for the full width of the area to be paved. All existing pavement edges shall be saw cut prior to installation of new pavement.

1. Fine grade earth subgrade and compact with self-powered rollers of sufficient size to provide a firm, unyielding surface to receive the aggregate base course. Remove and replace all unsuitable subgrade material as directed by the Engineer.

2. Where the subgrade is constructed by excavation of the existing grade, the top 6 inches of the subgrade shall be compacted to at least 95 percent of maximum density at optimum moisture content as determined in ASTM D 698.

3. When the subgrade is constructed on fill:

a. The existing grade shall be made smooth and compacted per section 3.2.A.2.

b. The subgrade shall be brought to the appropriate lines and grades utilizing select backfill and placed in accordance with the applicable requirements of Section 31 00 00, Earthwork.

4. Existing grades prior to placement of subbase or backfill shall be established such that when materials for construction are placed no rutting or displacement will occur.

B. No materials shall be placed on subgrades which are muddy or have water thereon.

3.3 PERMANENT PAVEMENT BASE COURSE INSTALLATION

A. Construct base course to thickness as shown on Drawings in equal layers. Installation shall be in conformance with County Standard Specification.

3.4 LIMESTONE SCREENINGS INSTALLATION

A. Construct limestone screenings course in the staging areas to thickness shown on the Drawings or as directed by engineer (min. 2 inches).

B. The screenings shall be spread evenly and thoroughly rolled with an approved three-wheel roller, weighing not less than 10 tons, until thorough consolidation is obtained. All depressions shall be filled with screenings, and the process of rolling and filling shall continue until a thoroughly compacted uniform surface, satisfactory to the Engineer, is produced. No segregation of large or fine materials will be permitted, but the screenings shall be sprinkled with water at times and in the amounts necessary to provide consolidation.

3.5 PAVEMENT INSTALLATION

A. The contact surfaces of all curbs, gutters, castings and adjacent pavement edges shall be painted with a layer of tack coat before placing or repairing the pavement course.

B. Bituminous concrete shall be constructed to thicknesses as shown on the Drawings and rolled with 12-ton self-powered two-axle or three-axle tandem or three-wheel roller to a density of 94 percent of maximum.

C. Pavement shall be uniform in appearance, free of bumps and hollows, worked to drain, and free of bleeding.

D. Trim the existing pavement by saw cutting of all loose edges and broom and tack coat all edges prior to placing the transition pavement.

E. In placing and compacting abutting courses of bituminous concrete pavements, joint heating devices shall be used on all joints (transverse, longitudinal and existing).

F. Bituminous pavement shall butt with the existing pavement in a smooth, even transition including a top sealing of the pavement joint with a bead of asphalt concrete.

G. Test bituminous pavement for conformity with the specified crown and grade immediately after initial compression. Correct variations by the removal or additional of materials and by continuous rolling.

H. The finished surface shall not vary more than 1/4 inch when tested with a 16-foot straightedge applied parallel with, or at right angles to, the centerline.

I. After final rolling, again test the smoothness of the course. Correct humps or depressions exceeding the specified tolerances or that retain water on the surface by removing the defective work and replacing with new material.

3.6 PATCHING

A. As directed by the Engineer, remove and replace all defective areas in temporary and permanent pavements. Cut-out such areas and fill with fresh bituminous concrete top course as specified in the County Standard Specification. Compact to the required density.

3.7 CLEANING AND PROTECTION

A. After completion of paving operations, clean surfaces of excess or spilled bituminous materials and all foreign matter.

B. Protect newly finished pavement until it has become properly hardened by cooling.

C. During the paving operation cover openings of drainage structures in the area of paving.

3.8 MAINTENANCE AND ACCEPTANCE

A. The Contractor shall maintain all paved surfaces until the roads and parking areas have been accepted. The paved areas will not be accepted until after the Contractor has completed all phases of the work, including all necessary transportation, hauling and severe usage of the paved areas. The Engineer shall be the sole judge in this matter. The warranty period shall be as noted in the Agreement.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Asphaltic concrete and temporary pavement will be measured for payment by the Ton of binder mixture and surface mixture acceptably placed within the lines and allowable tolerances shown on the plans or directed by the Engineer at no additional cost to the owner.

ITEM #	DESCRIPTION	UNIT
P	Temporary Asphaltic Concrete Binder Course	TONS
Q	Asphaltic Concrete Top Course	TONS
R	Asphaltic Concrete Binder Course	TONS

4.2 PAYMENT

A. Payment will be at the contract unit price tons which shall include all cost of furnishing and placing materials and labor and equipment required to complete the work as specified herein and shown on the contract drawings. No payment will be made for asphaltic concrete binder mixture and surface mixture and temporary pavement placed outside the required limits and allowable tolerance.

+ + END OF SECTION + +

SECTION 32 31 13

CHAIN LINK FENCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. DIVISION 01 - GENERAL REQUIREMENTS: Drawings, quality, product and performance requirements, general and supplemental conditions apply as applicable to the project and project documents.

1.2 SUMMARY

A. This Section includes commercial chain link fence and gates specifications:

1. Galvanized steel coated chain link fabric
2. Polymer coated steel chain link fabric
3. Zinc 5% Aluminum alloy coated steel chain link fabric
4. Galvanized steel framework and fittings
5. Polymer coated galvanized steel framework and fittings
6. Gates: swing
7. Installation

B. Related Sections:

1. 01 33 00 Submittal Procedures
2. 01 45 00 Quality Control
3. 01 60 00 Product Requirements
4. 03 30 00 Cast in Place Concrete

1.3 REFERENCES

A. ASTM A392 Specification for Zinc-Coated Steel Chain-Link Fence Fabric

B. ASTM A817 Specification for Metallic-Coated Steel Wire for Chain Link Fence Fabric and Marcelled Tension Wire

C. ASTM A824 Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link

D. ASTM F552 Standard Terminology Relating to Chain Link Fencing

E. ASTM F567 Standard Practice for Installation of Chain Link Fence

F. ASTM F626 Specification for Fence Fittings

G. ASTM F668 Specification for Polymer Coated Chain Link Fence Fabric

H. ASTM F900 Specification for Industrial and Commercial Swing Gates

I. ASTM F934 Specification for Standard Colors for Polymer-Coated Chain Link

J. ASTM F1043 Specification for Strength and Protective Coatings of Steel Industrial Chain Link Fence Framework

K. ASTM F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

L. ASTM F1184 Specification for Industrial and Commercial Horizontal Slide Gates

M. Comply with ASTM A 53 for requirements of Schedule 40 piping.

1.4 DEFINITIONS

A. Height of Fence: Distance from the top of concrete footing to the top of fabric.

1.5 SUBMITTALS

A. Shop Drawings: Complete detailed drawings for fence and gate.

B. Product Data: Manufacturer's catalog cuts, specifications, and installation instructions for each item specified.

C. Samples:

1. Fence Fabric: Minimum one sq ft.

2. Fence and Gate Posts: Two each, one ft long, if requested.

3. Miscellaneous materials and accessories: As requested.

1.6 QUALITY ASSURANCE

A. Comply with standards of the Chain Link Fence Manufacturer's Institute.

B. Provide steel fence and related gates as a complete system produced by a single manufacturer, including necessary erection accessories, fittings, and fastenings.

C. Posts and rails shall be continuous without splices.

D. Concrete batching plants shall be currently approved as concrete suppliers by the New York State Department of Transportation.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Framework, posts, rails, pipe for gate frames:

1. Wheatland Tube Co. 800 343 0124 e-mail: fence@wheatland.com www.wheatland.com

2. Or approved Equal.

2.2 MATERIALS

A. Class B Steel Tubing (Option):

1. SS-40 Fence Pipe by Allied Tube and Conduit Corp., Harvey, IL.

2. Tuf-40 Fence Framework by American Tube Corp., Phoenix, AZ.

2.3 STEEL FRAMEWORK (FOR FENCES 6'-1" - 10'-0" HIGH)

A. End Posts and Corner Posts: (Refer to drawing)

B. Line Posts: (Refer to drawing)

2.4 STEEL FABRIC

A. One-piece widths for fence heights up to 12'-0".

B. Zinc-Coated Steel Fabric: ASTM A392 hot dipped galvanized before or after weaving.

C. Chain link, No. 9 gage, 2 inch mesh.

D. Salvages: Top side twisted and barbed; bottom side knuckled.\

2.5 SWING GATE POSTS

A. Single width of gate up to 6'-0" wide and less than 10'-0" high.

1. Pipe: 2.875 inches OD, 5.79 lb per lin ft (Schedule 40).

2. Square Tubing: 2.50 inches OD, 5.70 lb per lin ft.

3. Class B Steel Tubing: 2.875 inches OD, 4.64 lb per lin ft.

4. Roll Formed C-Section: 3.5 inches x 3.5 inches x 0.128 inches thick, with minimum bending strength of 486 lb under a 6 foot cantilever load.

2.6 SWING GATE FRAMES

A. Height: 6'-0" - 12'-0", or leaf width exceeding 8'-0":

1. Pipe: 1.90 inches OD, 2.72 lb per lin ft (Schedule 40).

2. Square Tubing: 2 inches OD, 2.60 lb per lin ft.

3. Class B Steel Tubing: 1.90 inches OD, 2.28 lb per lin ft.

B. Assemble gate frames by welding or with special steel fittings and rivets for rigid connections. Install mid-height horizontal rail on gates over 10 feet high. When width of gate leaf exceeds 10 feet, install mid-distance vertical bracing of the same size and weight as frame members. When either horizontal or vertical bracing is not required, provide truss rods as cross bracing to prevent sag or twist.

2.7 GATE HARDWARE

A. Hinges: Pressed Steel Offset 180 degree gate hinge item no. 014005 or appropriate for use by Hearne Steel Company, Inc.

B. Latch: Forked type for single gates 10 feet wide or less. Plunger bar type, complete with flush plate set in concrete for double gates and single gates over 10 feet. Padlock eye shall be an integral part of latch construction.

2.8 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Rails and Post Braces:

1. Pipe: 1.660 inches OD, 2.27 lb per lin ft (Schedule 40).

2. Class B Steel Tubing: 1.660 inches OD, 1.84 lb per lin ft.

3. Roll formed C-Section: 1.625 inches x 1.25 inches x 0.0747 inches thick with minimum bending strength of 192 lb on a 10 foot span.

B. Fittings and Post Tops: Steel, wrought iron, or malleable iron.

1. Fasteners: One-way cadmium plated steel screws.

C. Stretcher Bars: One piece equal to full height of fabric, minimum cross-section 3/16 inch x 3/4 inch.

D. Metal Bands (for securing stretcher bars): Steel, wrought iron, or malleable iron.

E. Wire Ties:

1. For tying fabric to line posts, rails and braces: 9 gage steel wire.

2. For tying fabric to tension wire: 11 gage steel hog rings.

F. Truss Rods: 3/8 inch diameter.

G. Concrete: Portland Cement concrete having a minimum compressive strength of 4000 psi at 28 days.

H. Spiral Paper Tubes:

1. Sonotube by Sonoco Products Company.

2. Sleek/tubes by Jefferson Smurfit Corporation.

I. Tension Wire: 7 gage coiled spring steel wire.

J. Shrink-Resistant Grout (Ferrous): Factory-packaged, non-catalyzed, ferrous aggregate mortar grouting compound selected from the following:

1. Embeco 636 by Master Builders.

2. Ferrolith G-NC by Sonneborn.

3. Ferro-Grout by L&M Construction Chemicals.

4. Vibra-Foil by A.C. Horn.

K. Privacy slats

1. Vinyl Fence fabric slats:

a. Manufacturer: The Reinforced Vinyl Fence fabric with pre-inserted slats as manufactured by PrivacyLink®, LLC P.O. Box

295, Hyde Park, Utah 84318. The manufacturer may be contacted at 800-574-1076, 435-563-1058 or via fax at 435-563-1062.

b. Fabric Diameter & Finish. 3-1/2" x 5" mesh by 9 ga. (0.148") galvanized before weaving per ASTM A392 & A817, 1.2 oz Type II Class 4.

c. Fabric Color: gray or approved equal.

2.9 FINISHES

A. Steel Framework:

1. Pipe: Galvanized in accordance with ASTM A 53, minimum 2.0 oz zinc per sq ft.

2. Square Tubing: Galvanized in accordance with ASTM A 123, 2.0 oz zinc per sq ft.

3. Class "B" Steel Tubing: Exterior; 1.0 oz zinc per sq ft plus chromate conversion coating and clear polyurethane. Interior; zinc rich organic coating.

4. H-Section: Galvanized in accordance with ASTM A 123, 1.6 oz zinc per sq ft.

5. Roll Formed C-Section: Galvanized in accordance with ASTM A 123, 2.0 oz zinc per sq ft.

B. Fabric; one of the following:

1. Galvanized Finish: ASTM A 392 class II zinc coated after weaving, with 2.0 oz per sq ft.

C. Fence and Gate Hardware, Miscellaneous Materials, Accessories:

1. Wire Ties: Galvanized Finish, ASTM A 90, 1.6 oz zinc per sq ft, or aluminized finish, ASTM A 809, 0.40 oz per sq ft.

2. Hardware and Other Miscellaneous Items: Galvanized Finish, ASTM A 153 (Table 1).

D. Tension Wire; one of the following:

1. Galvanized Finish: ASTM A 121 class 3, 0.80 oz per sq ft.

2. Aluminized Finish: ASTM A 585 class 2, 0.30 oz per sq ft.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clear and grub along fence line as required to eliminate growth interfering with alignment. Remove debris from State property.

B. Do not begin installation of fence in areas to be cut until finish grading has been completed.

3.2 INSTALLATION

A. Space posts equidistant in the fence line with a maximum of 10 feet on center.

B. Setting Posts in Earth: Drill holes for post footings. Unless otherwise indicated, drill holes 3'-6" deep, 10 inches in diameter for line posts, 12 inches in diameter for all other posts. If existing grade at the time of installation is below finished grade, provide spiral paper tubes to contain concrete to finish grade elevation. Set posts in center of hole and fill hole with concrete. Plumb and align posts. Vibrate or tamp concrete for consolidation. Finish concrete in a dome shape above finish grade elevation to shed water. Do not attach fabric to posts until concrete has cured a minimum of 7 days.

C. Setting Posts in Rock: Drill holes into solid rock one inch wider than post diameter, 18 inches deep for end, pull, corner, and gate posts, and 12 inches deep for line posts. Set posts into holes and fill annular space with shrink-resistant grout.

D. Install top rail continuously through post tops. Install expansion couplings as recommended by fencing manufacturers.

E. Install bottom and intermediate rails in one piece between posts and flush with post on fabric side using special offset fittings where necessary.

F. Diagonally brace corner posts to adjacent line posts with truss rods and turnbuckles.

G. Attach fabric to security side of fence. Maintain a 2 inch clearance above finished grade except when indicated otherwise. Thread stretcher bars through fabric using one bar for each end and gate post and 2 for each corner and pull post. Pull fabric tight so that the maximum deflection of fabric is 2 inches when a 30 pound pull is exerted perpendicular to the center of a panel. Maintain tension by securing stretcher bars to posts with metal bands spaced 15 inches oc. Fasten fabric to steel framework with wire ties spaced 12 inches oc for line posts and 24 inches oc for rails and braces. Bend back wire ends to prevent injury. Tighten stretcher bar bands, wire ties, and other fasteners securely.

H. Position bolts for securing metal bands and hardware so nuts are located opposite the fabric side of fence. Tighten nuts and cut off excess threads so no more than 1/8 inch is exposed. Peen ends to prevent loosening or removal of nuts.

1. Secure post tops with one-way screws.

I. Install gates plumb and level and adjust for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

J. Tension Wire: Support bottom edge of fabric with tension wire. Weave tension wire through fabric or fasten with hog rings spaced 24 inches oc. Tie tension wire to posts with 9 gage wire ties.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

SECTION 32 92 00

GRASS RESTORATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: The General Construction Contractor shall furnish all labor, materials and equipment necessary to restore grass areas disturbed by the construction. The limits of restoration will be determined by the Engineer. Disturbance of grass areas shall be kept to a minimum during construction.

B. In the event that seeding restoration fails or is not feasible due to season, the Contractor shall be required to restore the grass areas with sod.

C. Related Work Specified Elsewhere:

1. Section 31 00 00, Earthwork

1.2 SUBMITTALS

A. General: Submit shop drawings in accordance with Section 013300 of the Contract Specifications.

B. The Contractor shall submit certificates of materials compliance before delivery of material for the following items:

1. Topsoil

2. Seed

3. Fertilizer (10-6-4)

4. Limestone

5. Mulch

PART 2 - PRODUCTS

2.1 TOPSOIL

A. The topsoil shall consist of a fertile, friable, natural top soil of loamy character, without admixtures of subsoil, uniform in quality and shall be free from refuse of any nature, hard clods, stiff clay, sods, hard pan, pebbles larger than 3/4 inch in diameter, coarse sand, noxious weeds, sticks, brush, or other rubbish.

B. The topsoil shall be taken from a well drained, arable site, preferably one which has been under cultivation at least 5 years previous to the time of removal.

C. The topsoil shall contain not less than 5 percent nor more than 20 percent organic matter, as determined by loss on ignition of oven-dried samples. The samples shall be thoroughly oven-dried to constant weight at a temperature of 221 degrees F.

D. The Hydrogen Ion value of all topsoil shall be not less than 5 and not more than 7. After the testing of the samples of material, if the loam is found to be unsatisfactory for the intended use, the Engineer may require that the Contractor, without additional compensation, add to the top soil proposed by him for use, lime, particular fertilizer or particular humus, as directed in order to make the topsoil suitable.

E. Mechanical Analysis: The sieve analysis on an oven-dried sample shall be as follows:

Sieve Size	% Passing by Weight
1 inch	100
1/4 inch	97-100
# 100	40-60
# 200	40-60

F. Topsoil available on site which meets the specified requirements may be utilized with the permission of the Engineer. The Engineer may require that the Contractor, without additional compensation, add to the topsoil proposed by him for use, lime, particular fertilizer or particular humus, as directed in order to make the topsoil suitable.

G. Imported topsoils or soil blends designed to serve as topsoil may not include the following:

1. Soils defined regionally by the Natural Resources Conservation Service web soil survey (or local equivalent for projects outside the U.S.) as prime farmland, unique farmland, or farmland of statewide or local importance; or

2. Soils from other greenfield sites, unless those soils are a byproduct of a construction process.

H. Restored soil must meet the criteria of reference soils in categories 1–3 and meet the criteria of either category 4 or 5: 1. organic matter; 2. compaction; 3. infiltration rates; 4. soil biological function; and 5. soil chemical characteristics.

	Soil criterion	Restoration to reference soil conditions	Required
1	Organic matter	Amend soils with mature, stable compost material such that top 12 inches (300 mm) of soil (at minimum) contains at least 3% organic matter OR organic matter levels and organic matter depth are comparable to site's reference soil	Yes
2	Compaction	Ensure bulk densities within 100% of root zone, defined as minimum of 12 inches (300 mm) in depth OR depth comparable to site's reference soil	Yes
3	Infiltration rate	Achieve infiltration rates (inches/hour) or saturated hydraulic conductivity (millimeters/second) comparable to site's reference soil	Yes
4	Biological function	Establish capacity of biotic community to decompose organic matter and release mineral (plant available) nitrogen; potentially mineralizable nitrogen is used as proxy (see Table 7.2-B, SITES Guidelines and Performance Benchmarks 2009)	Meet either or both of 4 or 5
5	Chemistry	Match pH, cation-exchange capacity, and nutrient profiles of original undisturbed soil or site's reference soil; salinity must be suitable for regionally appropriate vegetation	

2.2 SEED

A. General: Grass seed shall be fresh, recleaned seed of the latest crop. Material other than pure live seed shall comprise only nonviable seed, chaff, hulls, harmless inert matter and shall be free from noxious weeds. The mixture shall have less than one quarter (1/4) of one (1) percent weed content. Seed shall be mixed before delivery and shall consist of the mixture specified and in conformity with the following proportions by weight and meeting with the following standards of seed content. The percentage of purity shown on the label will be acceptable. The percentage of germination shall not be less than the minimum specified.

B. Mixtures

	Mixture Tolerance		Germination Tolerance	
Proportions of Mixture	Minus	Plus	Germination	Minus
90% Red Tall Fescue	3%	5%	90%	6%
10% Classic Kentucky Bluegrass	3%	5%	80%	7%

The following brand name mixtures are approved substitutes: Manhattan, Pennfine, N.K. 200 or Norlea in the proper percentages of mixture or any other current approved brand name mixture.

C. Packaging: All grass seed shall be delivered in unopened standard size bags of the vendor showing weight, analysis and the name of vendor. It shall be stored in such a manner that its effectiveness will not be impaired.

2.3 SOD

A. Materials

1. Sod shall be nursery grown and at least two years old. It shall be free of insects, grubs, fungus disease and noxious weeds and shall have a pH value of not less than 6.5.

2. The cultivated sod shall be 100% Merion grass sod.

3. Sod shall be a minimum of 1 inch thick and cut in uniform strips 1 foot by 4 feet minimum. Root development shall be capable of supporting sod during handling, transporting and laying. Sod shall not be installed in strips less than 1 foot in width.

4. Top growth shall be thick and matted. The turf shall be green and growing. Prior to cutting and transporting, the sod shall be well irrigated and have been recently mowed.

5. Native soil on the roots of the sod shall be maintained during process of transplanting.

6. Fertilizers shall be suitable commercial types.

B. Method

1. The surfaces of the areas to be covered with sod shall be trimmed, topsoiled to a minimum depth of 4 inches and graded to one inch below finished elevation by cutting and/or filling, as required, and as directed by the Owner.

2. The sod bed shall be raked and all foreign matter shall be removed and disposed of from the site.

3. Soil amendments and fertilizers shall be evenly spread over the prepared area and thoroughly raked in to incorporate it with the soil. Lime shall be incorporated in the soil at the rate of 50 pounds per 1000 square feet and superphosphate at the rate of 25 pounds per 1000 square feet.

4. Sod shall then be laid and set to the required grade on a reasonably moist bed with joints staggered. It shall be laid smoothly, edge to edge, and all openings plugged with sod. After laying, the sod shall be pressed firmly into contact with the bed by tamping and rolling to eliminate all air pockets and produce a uniform, even surface true to grade.

5. Sod shall be planted within 24 hours from the time of cutting unless tightly rolled or stored (roots to roots) and the stacks kept moist. Storage for a period in excess of five days will, under no circumstance, be

permitted. Should the completed sod surface become gullied, eroded, or otherwise damaged, the affected areas shall be re-sodded as required and at the Contractor's expense.

6. The Contractor shall be responsible for proper protection and maintenance of the sodded areas. Where sod fails to grow, the Contractor shall prepare and re-sod these areas at his expense. During dry weather the Contractor shall water the sodded area frequently enough to insure growth.

2.4 COMMERCIAL FERTILIZER

A. Composition: Commercial granular fertilizer shall have the following composition by weight: Nitrogen ten (10) percent; Phosphoric Acid six (6) percent; Potash four (4) percent. The Nitrogen shall be fifty (50) percent organic (from organic sources, e.g., fish meal, dried blood, dried manure, activated sewage sludge castor pomace, cottonseed meal, etc.) and fifty (50) percent inorganic. The elements shall be available according to the methods adopted by the Association of Official Agricultural Chemists.

B. Packaging: Fertilizers shall be packed in the manufacturer's standard containers weighing not over one hundred (100) pounds each with the name of the material, net weight of contents and the manufacturer's name and guaranteed analysis appearing on each container.

2.5 GROUND LIMESTONE

A. Composition: Ground limestone (calcium carbonate) shall have the following analysis: At least fifty (50) percent shall pass a two hundred (200) mesh sieve; at least seventy (70) percent shall pass a one hundred (100) mesh sieve; and one hundred (100) percent shall pass a ten (10) mesh sieve. Total carbonates shall not be less than eighty (80) percent or 44.8 percent calcium oxide equivalent; for purposes of calculation, total carbonates shall be considered as calcium carbonate.

B. Packaging: Ground limestone packed in the manufacturer's standard containers shall weigh not over one hundred (100) pounds each with the name of the material, net weight of contents and the manufacturer's name and guaranteed analysis appearing on each container. Bulk shipments shall be accompanied by a certificate covering the names, weight and analysis as specified herewith for packaged material.

2.6 MULCH-WOOD FIBER

A. General: Wood fiber suitable for use as mulch for seeding shall be processed so that the fibers will remain in uniform suspension in water under agitation and will blend with grass seed, fertilizer, ground limestone and other additives to form a homogenous slurry. It shall have the characteristics which, upon hydraulic application, shall form a blotter-like ground coating with moisture absorption and percolation properties and the ability to cover and hold grass seed in intimate

contact with the soil. Wood fiber shall contain no growth or germination inhibiting factors and shall be dyed green. The wood fiber mulch shall be Superior Fiber manufactured by Wolbert Master and Assoc. Inc., Silva Fiber as manufactured by Weyerhaeusar or equal.

B. Packaging: Wood fibers shall be supplied in the manufacturer's unopened standard containers weighing not over one hundred (100) pounds each, with the name of the material, net weight of contents, the manufacturer's name and the air dry weight of fiber (equivalent to ten [10] percent moisture) appearing on each container.

PART 3 - EXECUTION

3.1 GENERAL

A. When permitted by the Engineer, topsoil excavated under other Sections of this Specification shall be reused to provide a six inch layer of topsoil over the areas required to be seeded. If after backfilling of excavations there are insufficient quantities of top soil conforming to the specified requirements, the Contractor will be required to supply the necessary material to provide a six (6) inch layer of topsoil over the areas to be seeded. Where directed by the Engineer the surface of the subsoil shall be scarified or tilled to a minimum depth of two (2) inches before topsoil or soil is placed to permit bonding of the upper soil layer with the subsoil.

B. When delays in seeding operations carry the work beyond the specified seasons or when conditions of high winds, excessive moisture or frost are such that satisfactory results are not likely to be obtained for any stage of the work, the Engineer will stop the work. The work shall be resumed with the Engineer's approval when the desired results are likely to be obtained or when approved corrective measures and procedures are adopted.

C. The Contractor shall be liable for any damage to property caused by seeding operations and all areas disturbed shall be restored to their original conditions to the satisfaction of the Engineer.

D. One inch of water per week shall be applied on seeded areas for adequate soil saturation as required by weather conditions and as ordered by the Engineer until final acceptance. Watering shall be continued until final payment. Watering shall be done in a manner which will not cause erosion or other damage to the finished surfaces. Any surfaces which become gullied or otherwise damaged shall be repaired to reestablish the grade and conditions of the soil prior to seeding. After the repairs have been made the areas shall be reseeded as specified. Water for seeding is available on site

3.2 GRASS SEEDING

A. Time of Seeding: Seeding shall be performed from March 1 to April 15 and from August 15 to October 15 unless otherwise approved. The Contractor shall notify the Engineer at least 48 hours in advance of the time he intends to begin seeding and shall not proceed with such work until permission has been granted.

B. Preparation of Areas: The areas to be seeded shall be cultivated and cleaned of all vegetative growth to a depth of six (6) inches except as otherwise directed by the Engineer on designated areas where topsoil has been furnished and placed to a depth of six (6) inches immediately prior to seeding. All weeds, roots, stumps, large stones and debris shall be removed. All washouts or other surface irregularities shall be repaired and additional topsoil shall be placed over the area as required until the entire area to be seeded is covered with a minimum of six (6) inch compacted layer of topsoil. The areas to be seeded shall then be rough graded to conform to the proper elevations as directed by the Engineer.

C. Final Preparations of Seed Bed: The areas to be seeded shall be cultivated with a disc, rototiller or scarifier to a depth of four (4) inches. The areas shall be smoothly graded to the proper elevations, free from all unsightly ridges, depressions or undue irregularities. Areas to be seeded that cannot be cultivated by mechanical means shall be scarified by hand to attain the degree of smoothness and uniformity of adjacent lawn areas. Any soft areas shall be thoroughly compacted with an accepted roller weighing at least 200 pounds.

1. All topsoil not used is to be removed and disposed of.

2. Ground limestone shall be evenly distributed at the rate of one-half (1/2) pound per square yard and worked into the top three (3) inches of the soil during the cultivation required for the final preparation of seed bed.

3. Commercial fertilizer (10-6-4) as specified shall be evenly distributed at the rate of ten (10) pounds per 1,000 square feet using an approved mechanical spreader and shall be worked into the top one (1) inch of the soil.

4. In the event that it rains between the time the soil on any area is prepared and before it is seeded by any specified method, the soil on all areas to be seeded shall be completely pulvarized to a depth of one inch as determined, directed and approved by the Engineer.

D. Sowing Seed

1. Grass seed shall be sown evenly at the rate of one hundred fifty (150) pounds per acre. All seeding is to be done on dry or moderately dry soil and at times when the wind does not exceed a velocity of five (5) miles per hour.

2. A mechanical seeder may be used such as a Brillion seeder or equal to distribute the seed. Rolling will not be necessary.

3. If the grass seed is to be sown by hand the seed shall be evenly distributed and lightly raked into the top (1/4) inch of soil. After seeding and raking, the soil surface is to be rolled with an accepted roller weighting at least two hundred (200) pounds.

E. Seeding with Erosion Control Fabrics: Erosion control fabrics shall be applied in accordance with the seed manufacturers' instructions as modified, directed and approved by the Engineer.

3.3 ESTABLISHMENT OF SEEDED AREAS

A. The Contractor shall maintain, mow and protect the seeded areas until a uniform stand of grass approximately two and one half (2-1/2) inches high has been obtained (minimum of three cuttings). Any areas which have been damaged or fail to show a uniform stand of grass shall be scarified, refertilized and reseeded with the original seed mixture until all the designated areas are covered with grass.

+ + END OF SECTION + +

SECTION 33 05 05

BURIED PIPING INSTALLATION

PART 1 – GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish, install and test all buried piping, fittings, specials and appurtenances. The Work includes, but is not limited to, the following:

   a. All types and sizes of buried piping, except as specified under other Sections. These include, but are not limited to: ductile iron, carbon steel, copper, and thermoplastic.

   b. Supports, restraints, and thrust blocks.

   c. Testing.

   d. Cleaning and disinfecting.

   e. Also included are installation of all jointing and gasketing materials, specials, couplings, flexible couplings, sleeves, tie rods, corrosion protection, and all other Work required to complete buried piping installation.

   f. All valves, specials, sleeves and wall pipes shown or specified shall be incorporated into the piping system as required and as specified in the appropriate section of Division 22.

   g. Unless otherwise shown or specified, buried piping installation includes all buried piping Work required, beginning at the outside face of structure or building foundation.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work that is related to this Section, including concrete, valves, ventilation and electrical.

2. The installation of all buried piping materials specified in Division 22. Coordinate with these Sections.

C. Related Work Specified Elsewhere:

1. Section 31 00 00, Earthwork

2. Section 03 30 00, Cast-In-Place Concrete

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with applicable requirements of UL and other authorities having jurisdiction.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping.

2. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

3. AWWA C600, Installation of Ductile-Iron Water Mains and Appurtenances.

4. AWWA M23, PVC Piping.

5. ANSI B31.2, Fuel Gas Piping.

6. NFPA 54, National Fuel Gas Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Laying schedules and detailed drawings in plan and profile for all piping.

2. Full details of piping, valves, specials, joints, harnessing and connections to pipes and structures.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test results.

C. Certificate: Submit certificate of compliance with referenced standards.

D. Record Drawings: Submit in accordance with the requirements, Project Record Documents.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off delivery vehicle. Do not otherwise drop, roll or skid pipe.

Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved.

B. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.

C. Pipe, fittings and specials shall be unloaded and stored in areas designated on the drawings. Interiors shall be kept completely free from dirt and foreign matter.

D. No material furnished under this specification shall be shipped to the job site until all submittals have been approved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe bedding and backfill in accordance with Section 31 00 00, Earthwork.

B. Pipe materials required are listed in the Piping Schedules. Refer to applicable Sections for detailed materials Specifications.

C. General:

1. Pipe Marking:

a. Each piece of pipe or fitting shall be clearly marked with a designation which shall conform with designations shown on the Shop Drawings.

b. Class designation shall be cast or painted on each piece of pipe or fitting 4 inches in diameter and larger.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:

1. All piping shall be sloped to avoid high spots and low spots and to facilitate drainage.

2. Proper and suitable tools and appliances for the safe, convenient handling and laying of pipe shall be used.

3. Install piping as shown on the Contract Drawings, specified and as recommended by the manufacturer.

4. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Contract Drawings or Specifications.

5. Pipe, fittings and accessories that are cracked, damaged or in poor condition or with damaged linings will be rejected. At the time of laying, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being laid, it shall be removed and replaced with sound pipe by the contractor at his expense.

6. Minimum cover over buried piping shall be 4 feet unless otherwise shown or approved by Engineer.

7. Earthwork required is specified in Section 31 00 00.

B. Bedding Pipe:

1. Bed pipe with materials as specified below and as shown on the Contract Drawings.

a. Trenches shall be excavated to allow for the pipe bedding material required as indicated on the contract drawings. All loose and unsuitable material shall be removed from the trench bottom and backfilled with compacted select fill.

b. Pipe embedment material and limits shall be as indicated on the contract drawings placed in accordance with the requirements of Section 31 00 00, Earthwork,

1) .

c. Pipe embedment shall be placed in maximum 6-inch layers and compacted for the full width of the trench. Recesses in the embedment shall be provided around each joint to allow space for making joints and inspection.

2. Carefully and thoroughly compact all pipe bedding and fill.

3. No piping shall be laid until Engineer approves the bedding condition.

4. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.

C. Laying Pipe:

1. Conform to manufacturer's instructions and to AWWA C600, and AWWA M23 where applicable.

2. Install unless otherwise approved by Engineer. Remove all pipe accurately to line and grade shown and relay pipes that are not laid correctly.

3. Slope piping uniformly between elevations given.

4. Ensure that water level in trench is at least 6 inches below bottom of pipe. Do not lay pipe in water. Maintain dry trench until jointing and backfilling are complete.

5. Start laying pipe at lowest point and proceed towards the higher elevations, unless otherwise approved by Engineer.

6. Place bell and spigot pipe so that bells face upstream unless otherwise approved by Engineer.

7. Excavate around joints in bedding and lay pipe so that only the barrel receives bearing pressure from the trench bottom.

8. Permissible deflections at joints shall not exceed 75 percent of the amount allowed by manufacturer and in no case exceed AWWA standards.

9. Prior to laying pipe, every precaution shall be taken to ensure that no foreign material enters the piping.

10. All pipe and fittings shall be carefully examined for cracks, damage or other defects while suspended above the trench, before installation. Defective materials shall be immediately removed from site.

11. Interior of all pipe and fittings shall be inspected and all dirt, gravel, sand, debris or other foreign material shall be completely removed from pipe interior before it is moved into the trench. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.

12. Every time that pipe laying is not actively in progress the open ends of pipe shall be closed by a watertight plug.

13. Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.

14. Blocking under piping shall not be permitted unless specifically excepted by Engineer for special conditions. If permitted, conform to requirements of AWWA C600.

15. Repair protective coatings and linings in a satisfactory manner prior to backfilling. Refer to specific pipe specifications for coating systems required.

D. Jointing Pipe:

1. Clean completely all jointing surfaces and adjacent areas immediately before making joint.

2. Lubricate and adjust gaskets and "O"-rings as recommended by manufacturer.

3. After "O"-rings are compressed and before pipe is brought fully home, each gasket shall be carefully checked for proper position around full circumference of the joint.

4. Conform to AWWA C111 and to all applicable manufacturers recommendations pertaining to jointing pipe.

5. For mechanical joints the plain end shall be centered and pushed into the bell and the gasket shall be firmly pressed evenly into the bell. The gland shall be slid to the bell for bolting. All bolts with oiled threads shall be alternately torque tightened 180 degrees opposite to each other to seat the gasket evenly. The maximum torque shall be as follows:

Bolt Size (inches)	Applied Torque (ft-lbs)
5/8	50
3/4	80
1	90
1 1/4	150

All bolts and nuts shall be heavily coated with an approved bituminous or epoxy coating.

6. Solder Joints:

a. Ream or file pipe to remove burrs.

b. Clean and polish contact surfaces of joints.

c. Apply flux to both male and female ends.

d. Insert end of tube into fittings full depth of socket.

e. Heat joint evenly.

f. Apply continuous solder bead around entire circumference of joint.

7. Use hexagon head nuts and bolts on all flanged joints. Bolts shall neither project more than 1/4-inch from, nor fall short of the end of the nut.

8. Use ring gaskets unless otherwise specified or approved by Engineer. Maximum gasket thickness shall not exceed 1/8 inch. Gaskets shall be suitable

for service intended in accordance with manufacturers ratings and instructions.

9. Clean and lubricate bolt threads and gasket faces for flanged joints.

10. All bolts and nuts for underground service on valves, mechanical joint fittings, pipe joint and other ferrous metal appurtenances shall be packed in an asphaltic material. After the joint has been made and the bolts drawn to the proper tension, the joint, including glands, flanges, bolt heads and nuts shall be packed to a minimum thickness of one inch over all surfaces with Talcote, or other equal asphaltic material. Alternatively coat all joint areas and fasteners with two heavy coats of coal tar epoxy.

E. Concrete Trust Blocks:

1. Provide concrete trust blocks as shown, required, or otherwise approved by Engineer.

F. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

G. Closures:

1. Provide all closure pieces shown or required to complete the Work.

2. Locate closures in straight runs of pipe.

H. Backfilling:

1. Conform to applicable requirements of Section 31 00 00 - Earthwork.

2. Backfill by hand until pipe is covered by at least 1 foot of fill.

3.2 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown shall be considered approximate.

2. Contractor is responsible for determining exact location of existing piping to which he must make connections, or which he may disturb during earth moving operations, or which may be affected by his work in any way.

B. Work on Existing Pipelines:

1. Do not take pipelines out of service except where specified or approved by Engineer.

2. Cut or tap pipes as shown or required with machines specifically designed for this work.

3. Install temporary plugs to keep out all mud, dirt, water and debris.

4. Provide all necessary adapters, fittings, pipe and appurtenances required.

5. Refer to Section 31 00 00, Earthwork for additional requirements.

6. The Contractor shall provide a temporary thrust restraint system for existing pipes wherever the installation of new pipes disturbs the existing pipe's thrust restraint. Upon completion of new pipe installation, the Contractor shall restore the existing pipe thrust restraint system to its condition at the onset of the job.

3.3 TESTING OF PIPING

A. General:

1. Test all piping as specified below except as otherwise authorized by Engineer.

2. Notify Engineer 48 hours in advance of testing

3. Provide all testing apparatus, including pumps, hoses, gages, and fittings.

4. Unless otherwise noted, pipelines shall hold the specified test pressure for a period of 2 hours.

5. Pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate shall be repaired and retested.

6. Test pressures required are at the lowest elevation of the pipeline section being tested unless otherwise specified.

7. All gas piping shall be tested in accordance with NFPA 54.

8. Unless otherwise approved, conduct all tests in the presence of the Engineer.

9. All pipe shall be tested between valves.

B. Schedule of Pipeline Tests:

1. For pressure test values see "Piping Schedule."

2. Piping not on the schedule shall be tested at 1.5 times the maximum working pressure or 10 psi, whichever is greater.

C. Pressure Test Procedure (Except for Fuel Oil Piping and Gravity Sewer Pipe):

1. Backfill and compaction shall be completed at least to the pipe centerline before testing, unless otherwise required or approved by Engineer. Backfill and compact around all blocking before testing and as required to assure restraint by harnessed joints.

2. Allow concrete for blocking to reach design strength before testing.

3. Fill section to be tested slowly with water and expel all air. Install corporation cocks, if necessary, to remove all air.

4. Test only one section of pipe at a time.

5. Maintain the test pressure for at least 2 hours.

6. Allowable Leakage Rates (in gallons per hour per 1,000 feet per inch diameter) except as otherwise noted:

   a. Buried Ductile iron and PVC - as specified herein and as specified in AWWA C.600 - Section 4 - Hydrostatic Testing.

Nominal Pipe Diameter (inch)	Allowable Leakage Rate Per 1000 ft of Pipeline (gph)
4	0.34
6	0.50
8	0.67
10	0.84
12	0.01

   b. Exposed Ductile iron and PVC and pipe in tunnels: No leakage.

   c. Copper, steel and Thermoplastic: No leakage.

   d. Sodium hypochlorite and caustic Solution: No leakage.

7. All visible leaks shall be made tight regardless of the amount of leakage or results of the leakage tests. If the pipes tested do not meet the leakage requirements of the leakage tests, they shall be repaired and retested as necessary until the leakage requirement is met.

8. All Work found defective shall be repaired or replaced at the expense of the Contractor.

D. Test Procedure for Gravity Sewer Piping:

1. Backfill and compaction shall be completed at least to the pipe centerline before testing, unless otherwise required or approved by the Engineer.

2. After pipe trenches have been satisfactorily backfilled to the required depth, piping shall be checked by the Engineer to determine if any displacement of pipe has occurred. A bright light shall be flashed between manholes. If the illuminated interior of the pipe shows displaced pipe, improper alignment or any other defects, the defect shall be corrected as determined by the Engineer. Upon satisfactory completion of the displacement test, the pipe shall be tested for leakage.

3. The Contractor shall test each section of gravity sewer pipe between manholes for watertightness individually. No continuous sections shall be tested simultaneously.

4. The Contractor shall plug the downstream end of the pipeline under test and all outlets discharging into the upstream manhole.

5. The upstream manhole and the section of pipeline under test shall be filled by the Contractor with water. The elevations to which the manholes shall be filled is a minimum of 2 feet above the crown of the pipe, or at least 2 feet above existing groundwater, whichever is higher.

6. The pipe shall remain filled for an initial 1 hour period to allow for stabilization. Following the stabilization period, water shall be added to the required elevation.

7. Leakage loss shall be measured over a period of 4 hours. After the stabilization period, the Engineer will take 3 readings of the water level in the manhole, and 4 hours later, take 3 more readings. An average of the readings will be used by the Engineer to calculate leakage.

8. If the measured rate of leakage is less than or equal to the allowable leakage rate, the section of pipeline tested is acceptable. If the test fails, the section of pipe must be repaired or replaced at the expense of the Contractor, and retested by the same procedures. Regardless of the results of the leakage test, all visible leaks shall be repaired.

9. The maximum allowable leakage rate for any section of pipeline under testing shall not exceed 200 gallons per inch of internal diameter per mile of pipe per day.

10. At the conclusion of the test, clean all pipelines by flushing with water or other means, and remove any debris which may have entered the pipeline during construction.

3.4 CLEANING AND DISINFECTION

A. All piping shall be thoroughly cleaned and flushed prior to placing in service in a manner approved by Engineer.

B. Disinfection:

1. Disinfect all potable water piping wherever installed or relocated.

2. Completely clean interior of all piping and flush piping smaller than 12 inches prior to disinfection with water at a minimum velocity of 2 1/2 feet per second.

3. Conform to procedures described in AWWA C651 except that the tablet method will not be permitted unless otherwise approved by the Engineer.

4. Water for flushing, testing and chlorination shall be furnished by the Contractor.

5. Chlorine shall be supplied by Contractor.

6. Bacteriologic tests shall be performed by Contractor. A certified test laboratory report shall be submitted for approval by the Engineer.

7. Chlorine concentration in the water entering the piping shall be between 50 and 100 parts per million, such that a minimum residual concentration of 25 parts per million will be left after a 24-hour retention period. The operation shall be repeated as necessary to provide complete disinfection.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

NOT USED

4.2 PAYMENT

A. All costs for the work described in this section shall be included in other related work described in respective items. No separate payment will be made for this item.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 33 05 19

DUCTILE IRON WATER UTILITY DISTRIBUTION PIPING

PART 1 – GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete for thrust blocks: Section 03 30 00, Cast in Place Concrete

B. Section 33 05 20, Buried Piping Installation

1.2 REFERENCES

A. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

B. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

C. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids

D. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

E. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

F. AWWA C150/ANSI A21.50 - Thickness Design of Ductile Iron Pipe

G. AWWA C151/ANSI A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water

H. AWWA C153 - Ductile-Iron Compact Fittings, 3 inches through 24 inches and 54 through 64 inches, for Water Service

I. AWWA C606 - Grooved and Shouldered Joints

J. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners

K. ASTM B98 - Copper Silicon Alloy Rod, Bar and Shapes

L. ASTM C283 - Resistance of Porcelain Enameled Utensils to Boiling Acid

M. DIPRA - Handbook of Ductile Iron Pipe

N. NY Spec 24-C-38 - Caulking

1.3 DESIGN AND MANUFACTURING REQUIREMENTS

A. Ductile iron pipe shall conform to the American National Standards Institute (ANSI) and American Water Works Association (AWWA) Standards specified herein and recommendations as given in the Ductile Iron Pipe Research Association (DIPRA) "Handbook of Ductile Iron Pipe."

1.4 SUBMITTALS

A. Contractor shall submit Shop Drawings for approval of the Engineer. Submittals shall include, but not limited to, the

1. Shop Drawings.

2. Results of Certified Shop Tests.

3. Certified Letters of Compliance.

B. Shop Drawings shall include, but not be limited to:

1. Catalog data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various piping components and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.

2. Complete layout and installation drawings, including plans, sections and cross-sections showing elevations with clearly marked dimensions. Piece numbers which are coordinated with the tabulated pipe layout schedule shall be clearly marked. Scale and size of the drawings shall conform to the Contract Documents. Piping layout drawings shall indicate information on pipe supports, location, support type, hanger rod size, insert type and the load in pounds.

3. Details of pipe lining, coating, wrapping, insulation and painting of all pipe.

4. Weights of all component parts.

5. Tabulated pipe layout schedule shall include the following information for all pipe and fittings: service, pipe size, working pressure, joint type, wall thickness, piece number, and laying length.

6. Flexible couplings, with harness details if required.

7. Locations where pipe and valve identification signs will be placed.

1.5 QUALITY ASSURANCE

A. The pipe and fittings covered by these specifications shall be provided by the Contractor through qualified manufacturers experienced in the fabrication, castings and manufacture of the pipe materials specified herein. The pipe and fittings shall be designed, fabricated and installed in accordance with standards specified herein.

1.6 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall deliver, store and handle all pipe, fittings and couplings as specified in Contract Documents. Special care in handling shall be exercised during delivery, storage and handling of pipe to avoid damage and setting up stresses. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.

B. No material furnished under this Section shall be shipped to the job site until all submittals have been approved.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Ductile iron pipe and fittings shall be as manufactured by the following:

1. American Cast Iron Pipe Co., Birmingham, AL

2. McWane, Inc., Birmingham, AL

3. United States Pipe and Foundry (U.S. Pipe), Birmingham, AL.

4. Or approved equal.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. Pipe shall be in accordance with AWWA C151 for push-on or mechanical joint pipe and AWWA C115 for flanged pipe and shall be of grade 60 42 10 ductile iron. The above standards cover ductile iron pipe with nominal pipe sizes from three (3) inches up to and including sixty four (64) inches in diameter. Working pressure for the pipe shall be as called for in these Standards.

B. Pipe

1. All ductile iron pipe to be supplied under these specifications shall be manufactured in accordance with ANSI Specification A 21.51/AWWA C 151, latest revision. The thickness class for all ductile iron pipe up to and including 12" shall be class 56. Pipe is to be furnished with push on type

joints per ANSI Specification A 21.11/AWWA C 111, latest revision, complete with gaskets and lubricant.

2. All ductile iron pipe furnished under this contract shall be factory applied double cement lined in accordance with ANSI Specification A21.4/AWWA C 10, latest revision, and seal coated inside and out. Minimum thickness of cement lining shall be as follows: 3" through 12" (inclusive) 1/8" cement lining; 14" through 24" (inclusive) 3/16" cement lining; 30" through 36" (inclusive) 1/4" cement lining.

C. Fittings

1. All fittings shall be “full-bodied” mechanical joint, shall be cement mortar and lined, and fittings of all sizes shall be class 250. All fittings shall be made in accordance with ANSI/AWWA; A21.11/C110, A21.11/C111, latest revision. Sealing gaskets, follower glands, lubricant, tee head bolts and hexagonal nuts shall be provided in sufficient quantities for each fitting. All fittings to be cement lined , NSF61 approved seal coat.

2. Concrete thrust blocks to be provided at all bends and tees in accordance with the detailed drawings.

3. Where compact fittings are shown or indicated, items shall be in accordance with AWWA C153.

D. Joints

1. Unless otherwise specified, all joints for Ductile Iron Pipe shall be Push-On Joints, 2 degrees maximum deflection.

The following type joints shall be used as specified:

2. PUSH-ON JOINTS - Push-on joints shall be the Super Bell-Tite Joint of Amstead Industries, the Tyton Joint of U.S. Pipe and Foundry Company, the Fastite Joint of the American Cast Iron Company or such other joint as may be approved as equal by Westchester County. For each bell, there shall be furnished a rubber gasket. All of the above shall conform with the applicable provisions of ANSI Specification A21.11.

3. MECHANICAL JOINTS - The joint material shall conform to requirements of ANSI Specification A21.11. The mechanical joint installation shall conform to the latest ANSI Specifications. Surface of joint in contact with rubber gasket seal shall be brushed thoroughly with a wire brush just prior to assembly and all loose rust or foreign material shall be removed. The cleaned surface shall be brushed with soapy water just prior to slipping with torque indicating wrenches. The applied torque shall be within the ranges shown below:

SIZE OF BOLT	TORQUE (Foot-Pounds)
5/8”	40-60
3/4”	50-90
1”	70-100

When tightening bolts, the flanges shall be brought up toward the pipe flanges evenly by partially tightening first the bottom bolt, then the top bolt, then the side bolts and repeating the cycle until all bolts are within the specified torque range. Over stressing of bolts to obtain tightening will not be permitted.

Mechanical joints showing visible leakage at the maximum permitted torque shall be disassembled, thoroughly cleaned and reassembled.

4. FIELD LOK GASKET SYSTEM - Field Lok Gasket Systems shall be as manufactured by the U.S. Pipe and Foundry Company or approved equal.

   These gaskets shall be installed on push-on joint pipe.

5. JOINT RESTRAINT SYSTEMS - The Contractor shall provide joint restraint systems to prevent against joint separation of joints on all water main mechanical joint fittings. The materials shall be the Meg-A-Lug restrained joint system as manufactured by EBBA IRON SALES, INC., or approved equal in lieu of the rodding system. The mechanical joint restraint system shall incorporate a restraining mechanism in the follower gland which shall impart a multiple wedging action against the pipe. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. All dimensions of each gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices. If TR Flex pipe is utilized, pipe and fittings to be restrained shall be TR Flex restrained push-on joint type as manufactured by U.S. Pipe and Foundry Co., or approved equal Restraint for field cut pipe shall be with TR Flex Gripper Rings or approved equal. Where Gripper Rings are to be installed on pipe in the field, the instructions of the pipe manufacturer shall be followed. In addition to the Gripper Rings, the Contractor will install tie-rodding to the first bell on each side of the fittings, or valves.

   Where tie rods are used, the manufacturer's recommendation for the number of rods for size and pressure will be followed.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All ductile iron pipe and fittings shall be installed in accordance with the manufacturer's recommendations, approved shop drawings and as specified in the Contract Documents.

B. Where insulation is shown or specified in the Contract Documents, it shall be installed after the installation and testing of the pipe.

C. Where ductile iron pipe is in contact with soils, the pipe shall be encased in polyethylene film in accordance with AWWA C105 to isolate the pipe surface from contact with the soils.

D. Where field cutting of ductile iron pipe is permitted by the Engineer, ductile iron pipe shall be cut only by means of abrasive saws, hack saws, wheel type cutters or milling type cutters. The use of "squeeze" type pipe cutters and cutting torches will not be permitted. Also, the use of diamond points and dog chisels will not be permitted.

E. Temporary Bulkheads:

1. Temporary bulkheads shall be furnished at the ends of pipe sections where adjoining pipe have not been completed and are not ready to be connected.

2. All temporary bulkheads shall be removed when they are no longer needed.

3.2 HANDLING AND DISTRIBUTION OF PIPE

A. Special care in handling shall be exercised during delivery and distribution of pipe to avoid damage. Damaged pipe shall be rejected and replaced at the Contractor's expense. The pipe shall be stored prior to use in such a manner as to keep the interior free from dirt and foreign matter. Any pipe that becomes contaminated shall be mechanically cleaned and then swabbed with a 1% chlorine solution before it is incorporated in the work. It must be stressed that contamination in the line will prolong and impede the disinfection operation. Flushing cannot be too heavily relied upon for cleaning.

3.3 PIPE MARKINGS

A. Each length of pipe shall be marked with its weight, pressure class, the year it was made, and the word "Ductile".

3.4 CONNECTIONS TO EXISTING SYSTEM

A. Permanent connections are to be made to the existing distribution system at the locations shown on the Contract Drawings and shall be made up to conform to the

details as shown. The Contractor shall verify by test pit excavation the location of the existing pipe where excavations are to be made. No pipe laying will be started until required test pits have been excavated where connections are to be made or at the direction of the Engineer.

3.5 PIPE BEDDING

A. All pipes shall be laid on 6 inches of clean crushed stone which has been hand trimmed and compacted. The crushed stone shall be carried to the mid-diameter of the pipe, compacting in 6-inch layers. Bell holes shall be excavated in the bedding to provide the pipe with full length bearing. The material shall be well graded and the nominal size shall be 1/4 to 3/4-inch range. No recycled concrete shall be used for bedding.

3.6 LAYING PIPE

A. Proper and suitable tools and appliances for the safe and convenient handling and laying of pipe and fittings shall be used and shall in general agree with the manufacturer's recommendations. Deflections, however, shall not exceed 50 percent of the maximum amounts recommended. Deflections are to be performed after the pipe has been brought home in straight alignment. Care shall be taken to prevent the bell and cementing lining from being damaged. Any damaged pipe shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

B. The pipe and fittings shall be thoroughly cleaned and carefully examined at the time of laying and no pipe or fitting shall be installed which is known to be defective. If any such pipe or fitting shall be discovered to be defective after being laid, it shall be removed and replaced with a sound pipe or fitting by the Contractor at his expense.

C. The Contractor shall lay the pipe to conform to the lines and grades shown on the Contract Drawings or as directed by the Engineer. Following preparation of the subgrade, the pipe or fitting shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe. The pipe shall be clean inside, and both bell and spigot rings shall be examined carefully and burrs or spelter which might cut the rubber ring shall be removed.

D. When it is necessary to cut ductile iron pipe in the field, such cuts shall be made carefully in a neat workmanlike manner using approved methods to produce a clean square cut. The outside edge of the cut end shall be conditioned for use by filing or grindings a small taper, at an angle of about 30°. If it is necessary to cut TR-Flex pipe in the field, such cuts shall be made to allow for one end to have the manufacture's "weldment" for installation into TR¬Flex pipe or fittings. This requirement will also be necessary for the use of Gripper Rings or equal.

E. At the close of work each day, the end of the pipeline shall be tightly sealed with a cap or plug so that no water, dirt or other foreign substance may enter the pipeline and this plug shall be kept in place until pipe laying is resumed.

3.7 THRUST BLOCKING

A. Concrete blocking shall be provided at plugs, tees, bends, hydrants and at other locations as may be designated by the Engineer where a sizable unbalanced thrust will be developed. The blocking shall be, in general, of such shape and form that the load due to the thrust shall not exceed 2 tons per square foot against earth or 5 tons per square foot against rock when the water pressure in the line is carried at the test pressure. The excavation at such locations shall receive special attention with such hand trimming as may be required to provide a good bearing against undisturbed materials within as short a distance as possible from the pipe or fitting.

B. Where reactions are in the vertical plane, provisions to restrain the thrust shall be made to meet the existing field conditions by concrete anchorages.

C. Concrete shall conform to Item 03 30 00, "Cast-in-place Concrete", for thrust blocks are shown on the Contract Drawings and additional concrete thrust blocks ordered by the Engineer.

3.8 REMOVAL AND DISPOSAL OF WATER

A. The Contractor shall provide and maintain ample means and equipment for dewatering and properly disposing of all water and sewage flows entering the trenches and other parts of the work. The excavation shall be maintained in a dry condition and no foundation materials, pipe or concrete shall be placed in water unless approved by the Engineer. Water and sewage flows shall be disposed of in a manner avoiding injury to property or inconvenience to the public with the approval of the Engineer. All costs for dewatering as specified will be included under this Item for payment. Costs shall also include continuous pumping and all labor to maintain a continuous system. Any disposal of water to existing storm systems or waterways shall be filtered by the use of hay bales or other filtering systems (See 1.40). Absolutely no silt will be allowed to enter these systems.

3.9 EXISTING STRUCTURES

A. With exception of water, gas and sewer service connections, all known structures, including piping for water, sewers and drains, manholes, pavements, sidewalks, walls, fences, hydrants, poles and similar structures located on, or adjacent to, the proposed work are shown on the Contract Drawings. Such information is shown for the convenience of the contractor but is not guaranteed to be correct or complete. The location of underground structures shown may be inaccurate, and obstructions other than those shown may be encountered. The Contractor shall hereby distinctly understand that the Owner is not responsible for the correctness or sufficiency of the information given; that he shall have no claim for delay or extra compensation

on account of incorrectness, insufficiency or absence of information regarding obstructions revealed or not revealed by the Contract Drawings; and that he shall have no claim for relief from any obligation or responsibility under the contract because the extent, location, size or character of any pipe or other underground structure is incorrectly shown or has been omitted from the Contract Drawings.

B. The location of the pipe to be laid as shown on the Contract Drawings is in accordance with the best information available as to the obstructions to be avoided, but can be considered only as approximate and may be changed by the Engineer if the progress of the work reveals other obstructions.

3.10 INTERRUPTED SERVICES

A. The Contractor shall notify affected property owners at least forty-eight (48) hours in advance of his intent to open a trench or interrupt any public service. The Contractor shall again notify such affected owners at least three hours in advance of the contemplated operation.

3.11 MAINTENANCE OF OPERATIONS

A. It is essential to the public health and safety that the operation of any public and private water supply, sanitary sewer and storm sewer services be maintained. The Contractor will be required to work in close cooperation and coordination with the Owner and its duly authorized agents to ensure that a minimum of interruptions of operations and nuisances result from his procedures. Only such interruptions of operations as are approved by the Engineer will be permitted.

3.12 MAINTENANCE OF UTILITY SERVICES

A. Utility services to customers shall be maintained at all times except when interruptions are specifically permitted by the Owner or the authority having jurisdiction thereover.

B. Gas, electric, water and any other services with the exception of drains which are found, in the opinion of the Engineer, to require relocation either in alignment or elevation shall be so relocated by the Utility at the Owner's request. The Contractor shall coordinate each relocation with the Owner and shall have no claim for delay.

C. Existing storm drains where noted on the Contract Drawings that require relocation in elevation, including modification of inlets or catch basins shall be included for payment under this item.

D. Storm drains or drains (not noted on the Contract Drawings) that are found, in the opinion of the Engineer, to require relocation either by alignment or elevation shall be so relocated by the Contractor and paid for as extra work.

E. Services which are damaged by the Contractor during construction and which do not require relocation shall be repaired or replaced at the expense of the Contractor.

F. Sanitary sewers may require bypass pumping at water main crossings and locations where the sewers run parallel to the new water mains. The Contractor shall be responsible for bypassing. All costs associated with bypassing shall be included for payment under this Item.

3.13 PROTECTION OF PROPERTY AND STRUCTURES

A. The Contractor shall, at his own expense, sustain in their places and protect from direct or indirect injury all pipes, poles, conduits, walls, buildings and other structures, utilities and property in the vicinity of his work. Such sustaining and protecting shall be carefully done by the Contractor and as required by the company or party owning the structure or department controlling it. The Contractor shall take all risks attending the presence or proximity of pipes, poles, conduits, walls, buildings and other structures, utilities and property in the vicinity of his work and he shall be responsible for all damage and assume all expense for direct or indirect injury, caused by his work, or to any person or property by reason of injury to them whether such structures are or are not shown on the Contract Drawings.

3.14 CONNECTION TO EXISTING MAINS

A. Where connections are to be made to existing pipe, the locations of the existing mains are approximate. The Contractor shall verify by test pit excavation the location of the existing pipe where connections are to be made. The existing pipe is active, and all precautions shall be made to prevent pipe separation when excavating in the vicinity of the thrust blocks and when removing the thrust block to make the connections. The cost to excavate, backfill and restore the test pit shall be included under this item.

B. The Contractor's attention is directed to the possibility that compressed air may be present behind plugs and caps to be removed. Before removing thrust blocks at ends of plugs and caps, or before loosening plugs and caps on restrained pipe, the pressure behind the plugs and caps must be relieved by operation of existing corporation stops, house service connections, hydrants, or other positive means. The cost for making connections to existing mains shall be included under this Item.

3.15 FLUSHING AND TESTING

A. The Contractor shall flush, hydrostatic test, and disinfect in this sequence the pipeline as follows:

B. Keep Pipe Clean and Dry - Precautions shall be taken to protect pipe interiors, fittings and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe laying is not in progress, as, for example, at the close of the day's work, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipes in the trench shall be completed before work is stopped. If water accumulated in the trench, the plugs shall remain in place until the trench is dry.

C. If dirt that, in the opinion of the Engineer will not be removed by the flushing operation enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary with a 5 percent hypochlorite disinfecting solution.

D. Flushing – The Contractor shall flush the pipeline in sections governed by the sources of clean water and suitable discharge points. The pipe section shall be flushed until the water runs clear. The Contractor is advised that flushing does not create sufficient velocities to clear the pipeline of matter that may cause an unsatisfactory bacteriological test. Permission of the Engineer to stop flushing or directions to continue flushing shall involve no responsibility for the results of the bacteriological tests.

E. Hydrostatic Tests – The Contractor shall make hydrostatic tests upon all sections of the pipeline in the presence of the Engineer. The hydrostatic tests shall-be made in accordance with Westchester County Department of Health and AWWA Standard C600, Section 4-Hydrostatic Tests, and latest Edition and to the test gradients shown on the Contract Drawings.

F. The Contractor shall furnish, install, complete with reaction blocking, necessary plugs and caps required for this operation. Main line valves shall be utilized wherever possible to segregate test sections except as directed by the Engineer.

G. The Contractor shall furnish all test equipment including pumps, gages and meters. The test equipment shall be approved by the Engineer. Calibration tests shall be furnished.

H. The line shall be filled with water for a period of no less than 24 hours then subjected to test pressure of 150 psi. During this test, the measured leakage over a period of 2 hours shall not exceed 50% of the allowable quantities as indicated in AWWA Standard C600, Section, 4, Hydrostatic Testing, for the size of pipe being tested. All air shall be purged from the line before testing.

I. The contractor shall notify the Westchester County and the Engineer at least 48 hours prior to performing any testing.

J. The contractor shall retain, at the contractor’s cost, a Licensed Professional Engineer to witness all testing and perform the necessary certifications and filings for acceptance of the completed works.

3.16 DISINFECTION

A. Disinfect pipe and fittings in accordance with Section 331300 after completion of pressure and leakage tests.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Cement lined ductile iron pipe and fittings will be measured along the centerline of the installed pipe, closures and valves, and along the tangents of bends for payment by linear foot acceptably placed within the lines and allowable tolerances shown on the plans or directed by the Engineer.

The quantities to be measured for payment shall be as described below:

ITEM #	DESCRIPTION	UNIT
D	Cement Lined DIP for Water Mains – 12" Dia., Class 54	Linear Foot
E	Cement Lined DIP for Water Mains – 10" Dia., Class 54	Linear Foot
F	Cement Lined DIP for Water Mains – 6" Dia., Class 54	Linear Foot
G	Cement Lined DIP for Water Mains –4" Dia., Class 54	Linear Foot
H	Misc Fillings (elbows, bends, fittings and tee's)	Pound

4.2 PAYMENT

A. Payment will be at the contract unit price per linear foot which shall include all cost of furnishing and placing materials and labor and equipment required to complete the work as specified herein and shown on the contract drawings, including watermain piping and fittings, concrete thrust blocks, pipe bedding, dewatering, connecting the new water mains to existing water mains, excavation and backfill, disinfection and testing. No payment will be made for pipe and fittings placed outside the required limits and allowable tolerance. Fittings such as tees and elbows shall be measured and paid for by pound weight.

+ + END OF SECTION + +

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Valve Schedule: Submit the valve schedule listing type of valve, manufacturer's model number and size, for each valve type required.

B. Product Data: Catalog sheets and specifications for each valve type and size and all other items required by this Section.

1.2 DESCRIPTION

A. Provide all labor, materials and equipment necessary to furnish, deliver and install valves as shown on the plans. Included hereunder is excavation and backfill; granular bedding; disposal of excess materials; sheeting and shoring; dewatering; protection of watermain structures; saw cutting and removal of pavements; temporary asphalt pavement; valve extension box.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Mueller Valve Co., 500 W. Eldorado St., Decatur, IL 62525, (217) 423-4471, or approved equal.

2.2 MECHANICAL JOINT VALVES

A. Both Tapping and Standard Valves shall be of the resilient gate type manufactured by Mueller Company, Decatur, Illinois, 62525. Valves shall open right (clockwise) and shall fit the Tapping Sleeve supplied. Gate valves 2-inches to 12 inches shall be series 2360. Tapping valves shall be series T2360. All valves are to be designed for a 200 pound per square inch working pressure and 400 pound per square inch test pressure. Tapping Valves shall be compatible with the S-54 Tapping Machine as manufactured by U.S. Pipe and Foundry, Burlington, New Jersey.

B. Mechanical joint tapping sleeve shall be models: H-615, H-616; ANSI B 16.1, class 125 certified ANSI/NSF 61 as manufactured by Mueller Company.

2.3 MATERIALS

A. Body:

1. Cast Iron: ASTM A-126 Class B, higher strength cast iron.

2. Ductile Iron: ASTM A-536 Grade 65-45-12.

3. Bronze: For use up to 150 WSP, ASTM B-62; over 150 to 300 psig WSP, ASTM B-61.

B. Stem:

1. Cast Manganese Bronze: ASTM B-584.

2. Cast Silicon Brass: ASTM B-584.

3. Rolled Silicon Brass: ASTM B-98 Alloy D.

4. Rolled Aluminum Bronze: ASTM B-150 Alloy 1.

5. Rolled Manganese Bronze: ASTM B-138 Alloy A (half hard).

6. Naval Brass: ASTM B-21 Alloy A or Alloy C (hard).

7. Silicon Bronze: ASTM B-371 Alloy C69400.

8. Stainless steel, Type 304.

2.4 CORPORATION STOPS

A. Ground key type unless otherwise noted. Acceptable Manufacturer: Mueller Co.

2.5 CURB STOPS

A. Round-way, ground key type unless otherwise noted. Acceptable Manufacturer: Mueller Co.

2.6 VALVE BOXES

A. Cast iron adjustable type box and cover extending from the valve to final grade. Cover of box shall be complete with an indicating arrow cast on it denoting direction of valve opening.

2.7 VALVE KEYS

A. Furnish one steel socket key for each five valves of the same size or less. For each additional five valves of one size or multiple thereof, furnish one additional key. Provide service box keys, for valves less than 3 inches in size with stationary rod, where required by the service or noted. Acceptable Manufacturer: Mueller.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install valves of type and kind as indicated on the drawings, each complete with operator and accessory items as required by the actual location. Size valves the same size as the piping in which they are installed, unless otherwise indicated.

3.2 VALVE BOXES

A. Install a valve box and cover, extending from the valve to final grade, for each gate valve buried in the ground.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Water main valves will be measured for payment by each acceptably placed within the lines and allowable tolerances shown on the plans or directed by the Engineer.

The quantities to be measured for payment shall be as described below:

ITEM #	DESCRIPTION	UNIT
I	Inline Gate Valve -12" diameter	EA.
J	Inline Gate Valve -10" diameter	EA
K	Inline Gate Valve -6" diameter	EA
L	Inline Gate Valve -4" diameter	EA

4.2 PAYMENT

A. Payment will be at the contract unit price per each which shall include all cost of furnishing and installing materials and labor and equipment required to complete the work as specified herein and shown on the contract drawings including excavation and backfill; granular bedding; disposal of excess materials; sheeting and shoring; dewatering; protection of watermain structures; saw cutting and removal of pavements; valve extension box. No payment will be made for water main valves placed outside the required limits and allowable tolerance.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 33 12 17

INSERTION VALVE (LIVE SHUT DOWN)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install Insertion Valves of the size and type specified.

1.2 REFERENCES

ASTM A 36 - Standard Specification for Carbon Structural Steel.

ASTM A 105 - Standard Specification for Carbon Steel Forgings for Piping Applications.

ASTM A 181 - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.

ASTM A 283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

AWWA C207- Steel Flanges for Pipes

AWWA C223- Fabricated Steel and Stainless Steel Tapping Sleeves

AWWA C509- Resilient-Seated Gate Valves for Water Supply Service

AWWA C515- Reduced-Wall, Resilient-Seated Gate Valves

AWWA C 111 - American National Standard for Rubber Gasket Joints tbr Ductile- Iron Pipe and Fittings for Water.

ASME 816.5 - Pipe Flanges and Flanged Fittings.

1.3 RELATED SECTIONS

1. Section 33 05 05, Buried Piping Installation

2. Section 33 05 19, Ductile Iron Water Utility Distribution Piping

3. Section 33 12 16, Water Utility Distribution Valves

4. Section 33 14 17, Site Water Utility Services

1.4 DEFINITIONS:

A. Insertion Valves are line stop type valves used for isolating sections of existing water line when existing valves do not exist or are deemed inoperable.

B. Line is stopped/plugged when 95 percent or more of pipe's existing water flow has been stopped.

1.4 SUBMITTALS

A. Conform to requirements of Submittals section of Contract.

B. Submit qualifications and certificate from manufacturer certifying operators are qualified to operate manufacturer's pipe plugging equipment.

C. Submit qualifications of hot tap operating technician as being certified by manufacturer to operate hot tapping equipment.

D. Submit qualifications of manufacturer verifying a minimum of 5 years of experience performing hot tapping operations.

E. Submittal must include manufacturer's cut sheet and order data sheet that lists among other information, valve orientation, gearing if applicable, if the valve is to be blind flanged or will be a permanent installation with valve box assembly, and other information related to tapping sleeve such as the type of steel, type of nuts, bolts and washers, type of coating, class of flange, and pressure rating of body all meeting the requirements listed in the descriptions under Materials.

F. Submit six (6) sets of shop drawings for approval prior to start of fabrication. Identify any special procedures required during and or after tapping procedure for the specified pipe material being tapped.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Valve materials meeting AWWA Standards C-509 or C515

B. Acceptable manufacturer:

1. Team Industrial Services, Insert Valve 4"-16", for vertical or horizontal installation. Miter gearing required on horizontal installation.

C. Tapping Sleeves: Steel Full-Body Type for Line Stops AWWA C223, fabricated from carbon steel meeting ASTM A283 Grade C or ASTM A36

D. Acceptable Manufacturers/Models:

1. For use on Cast Iron, Ductile Iron and PVC Pipe: JCM Industries, Inc, JCM 444ESS with 304 stainless steel nuts, bolts, and washers, AWWA C207 Class D blind flange, minimum 200 psi rated body and flange, minimum 12 mil thick epoxy coating inside and out on all components OR Pre-approved equal meeting AWWA C223, fabricated from carbon steel meeting ASTM A283 Grade C or ASTM A36. Sleeves must have mechanical joint ends on the body conforming to AWWA C110 and C111; a flanged outlet conforming to AWWA C207 Class E and must include plain MJ gaskets, split MJ glands and side flange gaskets. Outlet flange must be threaded for completion plug installation.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHOD

A. Pipe Preparation:

1. Thoroughly clean pipe down to factory supplied outside diameter. Carefully inspect pipe, especially at point where field welding will take place.

2. Conduct an ultrasound test to verify pipe wall thickness to ensure sufficient wall thickness is present in pipe to permit safe field welding of hot tap/line plugging saddle.

3. Grind spiral welds flush with outside of main prior to installation of saddle.

B. Tapping Sleeve Installation:

1. Place top half of saddle with flanged outlet at the 12 o'clock position on pipe, unless otherwise approved by Owner's Representative. Install sleeve in accordance with manufacturer's recommendations. In no case will saddle or attachments be retrofitted while it is on pipe, unless otherwise approved by Owner's Representative. Any misalignment in Installation will require removal of saddle from pipe.

2. If line stop type valve is unsuccessful in reducing 95 percent of existing water flow, mechanically clean interior of pipe as approved by the Engineer. Do not damage pipe's interior lining during mechanical cleaning.

3. Successful installation will result in reducing approximately 95 percent of existing water flow. Anticipate water leakage from pipe plug and include cost of water removal in unit price bid.

4. Conduct pipe excavation in accordance with specification Section 33 05 05, Buried Pipe Installation.

5. Pressure Testing: After sleeve is attached and before line tapping procedure begins, pressure test saddle in accordance with specification 33 05 19, Ductile Iron Water Utility Distribution Piping.

6. Tap Procedure: Perform tap in accordance with specification 33 05 19, Ductile Iron Water Utility Distribution Piping.

7. Plan water line stop procedure in such a manner and at such hours to minimize disruption and inconvenience to the public. Notify Owner's Representative at least 48 hours in advance of procedure.

8 The Contractor will operate all valves necessary to make shutoffs on existing water mains under the supervision of the Engineer. Notify the Engineer and Owner on the job at least 72 hours prior to the desired time for any shutoff.

9. Conduct line stop operations in presence of the Engineer. Continue water line stop valve installation work without interruption until operation is complete and water line is successfully plugged. Perform related work on connection to water main or associated work requiring installation of an isolation valve continuously and without interruption.

10. When left in place as a permanent valve, the depth of cover to the operating nut must be at least 18 inches to accommodate a valve box assembly, regardless of valve orientation. Gearing is required on horizontal valves and on valves 24 inches and larger regardless of valve orientation.

11. Apply external coating to saddle, flange and water main.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. This item will be measured by each 12" diameter Insertion Valve, furnished and installed.

4.2 PAYMENT

A. The work performed, and materials furnished in accordance with item and measured as provided under "Measurement" will be paid for at the unit price bid for Insertion Valve (complete) of the size and type specified. This price is full compensation for dewatering, trenching, excavation and backfill, preparation of existing pipe and valve box for permanent installations, and will include all materials, labor, equipment, tools, testing and incidentals necessary to complete the work

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 33 12 19

WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Section 33 05 19, Ductile Iron Utility Pipes.

B. Section 31 23 33, Trenching and Backfilling.

C. Section 33 12 16, Water Utility Distribution Valves.

1.2 QUALITY ASSURANCE

A. Approved Manufacturers: Clow, Darling, Kennedy, Mueller, Waterous Company.

1.3 SUBMITTALS

A. Product Data: Catalog cuts of fire hydrants and appurtenances.

B. Certificate: Furnish written certification indicating the AWWA C-502 required tests on materials and completed hydrants have been accomplished.

PART 2 - PRODUCTS

2.1 FIRE HYDRANTS

A. New hydrants shall be Super Centurion 250, Model A-423, three-way type, dry barrel and Traffic Model design, with Aqua-Grip, as manufactured by Mueller Company and American B-62-B-5, and conform to the latest revision of AWWA C502 Standards with 5.25-inch diameter main valve. Also the hydrant shall:

1. be rated for 250 psig (1723kPa) maximum working pressure;

2. have a high flow capacity with 6-inch mechanical joint inlet connection;

3. three-way nozzle arrangement of one pumper nozzle and two hose nozzles. The hose nozzles shall have 2.5-inch nominal inside diameter (ID) and 3-inch outside diameter (OD) with eight (8) threads per inch –type of thread – New York Corporation. The pumper nozzle shall have 4.5-inch ID and 5.75-inch OD with four (4) threads per inch – type of thread – National Standard;

4. have a 1.5-inch pentagon shaped operating nut that opens counter-clockwise;

5. have five (5) feet of bury, unless otherwise noted.

2.2 MISCELLANEOUS MATERIALS

A. Paint: Hydrant manufacturer's standard primer and 2 finish coats of rust inhibitive, high gloss alkyd enamel. Match color of other hydrants at the Facility.

B. Crushed Stone: DOT No. 3A; comply with the material requirements of NYSDOT Section 703-02.

C. Tools: Furnish 2 wrenches to fit fire hydrants. Deliver wrenches to the Director's Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The fire hydrant shall have a 6-inch, cement lined DIP lateral that connects the hydrant with a new/existing water main. A 6-inch resilient wedge valve that opens clock-wise shall be installed between the hydrant and the supply main to permit isolation of the hydrant for maintenance purposes.

B. A valve box shall be provided for the valve. The valve box shall be of three piece, cast iron construction, and adjustable screw-type with 5-1/4-inch shaft. It shall be designed for heavy traffic. The cover shall be round and shall be marked "WATER."

C. The valve box shall be placed on concrete and shall be centered plumb over the operating nut of the valve. It shall be adjusted so that the cover will be flush with the finished grade of the pavement or ground.

D. Hydrants shall be cleaned and their operation checked before installation. The hydrant barrel shall be set so that the pumper or hose nozzle cap will be 24 inches from the gutter face of the road's curb or as directed by the Engineer.

E. When hydrant is set in the median between the curb and the sidewalk or between the sidewalk and the property line than, no portion of the hydrant or nozzle cap shall be within 12 inches of the sidewalk.

F. The hydrant shall stand plumb and shall be set to the established grade, with nozzles at least 18-inches above the ground, as shown on drawing or as directed by the Engineer.

G. The pumper outlet nozzle shall face the street and the hose nozzles shall be parallel with the curb.

H. The hydrant shall rest on a block of concrete of adequate size. Thrust blocks shall

be placed against undisturbed ground. It shall be strapped with rods in two distinct operations.

I. The tee at the supply main shall be rodded to the hydrant branch valve and then from the valve to the hydrant. The tie rods shall be ¾-inch diameter cold rolled steel, full threaded. They hydrant base shall be surrounded by ¾-inch clean crushed stone/gravel to a level of 6-inches above the drain outlets (weep-holes). The stone shall be extended at least 1-foot on all sides of the hydrant. The stone shall be covered with 8-mil polyethylene or similar waterproof material before backfilling.

J. An assurance shall be made that the weep holes are clear and the hydrant properly drains after use.

K. The newly installed hydrant shall be disinfected and tested for proper drainage in accordance with AWWA Standards. Any hydrant that does not properly drain shall be re-excavated and corrections shall be made to ensure proper drainage.

L. The area that was disturbed during the installation/replacement of the hydrants shall be restored to match the existing conditions.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Fire hydrants will be measured for payment by each acceptably placed within the lines and allowable tolerances shown on the plans or directed by the Engineer.

ITEM #	DESCRIPTION	UNIT
N	Fire Hydrant Assembly	E.A.

4.2 PAYMENT

A. Payment will be at the contract unit price per each which shall include all cost of furnishing and placing materials and labor and equipment required to complete the work as specified herein and shown on the contract drawings. Payment shall include excavation and backfill; pipe restraints, granular bedding; disposal of excess materials; sheeting and shoring; dewatering; protection of existing structures; valve extension box. No payment will be made for fire hydrants placed outside the required limits and allowable tolerance.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 33 13 00

DISINFECTION OF WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. Conform to provisions of AWWA C-651 for water line disinfection. Do not use Tablet Method therein.

C. Comply with all requirements of the New York State Department of Health for disinfection of potable water lines, valves, hydrants, storage tanks, and appurtenances.

1.2 SUBMITTALS

A. Contract Closeout Submittals:

1. Test Results.

PART 2 - PRODUCTS

2.1 DISINFECTANT

A. Chlorine Gas meeting AWWA B301.

B. Hypochlorites meeting AWWA B300.

2.2 TEST KITS

A. High range test kit for chlorine residual (0-200 mg/1) Hach Chemical Co. Model CN-21P.

B. DPD chlorine residual test kit (0-3.5 mg/1) Hach Chemical Co. Model CN-66.

C. Test kits to remain property of the Contractor.

PART 3 - EXECUTION

3.1 DISINFECTION - WATER MAINS

A. Flush mains with clear water at a minimum rate of 2.5 fps prior to disinfection. See Table 1.

TABLE 1 - WATER MAIN FLUSHING DATA		
PIPE DIAMETER (INCHES)	**FLUSHING RATE GPM @ 2.5 fps**	**HYDRANT OPENINGS @ 40 psi**
2	25	one - 2-1/2
4	100	one - 2-1/2
6	220	one - 2-1/2
8	390	one - 2-1/2
10	610	one - 2-1/2
12	880	one - 2-1/2
14	1200	two - 2-1/2
16	1570	two - 2-1/2
18	1985	two - 2-1/2
24	3525	one - 4-1/2 and one - 2-1/2

B. Chlorine Gas: Apply with a solution-feed chlorinator in combination with a booster pump for injecting the chlorine gas-water mixture into the main. Do not use direct feed chlorinators.

C. Hypochlorites: Apply solutions to water mains with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions.

D. Application (Continuous Feed Method).

1. Connect chlorinator or force pump to water main upstream from point of repair or replacement, or new lines.

2. Proportion application rate of chlorine solution to obtain a minimum concentration of 50 mg/1 of available chlorine. Use high range test kit to determine concentration. See Table 2.

TABLE 2 - QUANTITY OF DISINFECTANT REQUIRED FOR 50 mg/l OF AVAILABLE CHLORINE PER 100 FT. OF PIPE

PIPE DIAMETER (INCHES)	POUNDS		OUNCES			QUARTS	
	Cl GAS	SOLUTION 70%	HYPOCHLORITE 70%	14.7%	5.25%	14.7%	5.25%
2	0.1	0.1	0.2	0.8	2.1	0.1	0.1
4	0.1	0.1	0.6	3.0	8.3	0.1	0.3
6	0.1	0.1	1.4	6.7	18.7	0.2	0.6
8	0.1	0.2	2.5	11.9	33.2	0.4	1.1
10	0.2	0.3	3.9	18.5	51.9	0.6	1.6
12	0.3	0.4	5.6	26.7	74.7	0.9	2.4
14	0.4	0.5	7.6	36.3	102.0	1.2	3.2
16	0.5	0.7	10.1	47.5	133.0	1.5	4.2
18	0.6	0.8	12.6	60.0	168.0	1.9	5.3
24	1.0	1.4	22.4	107.0	298.0	3.4	9.4

3. In the absence of a meter, determine rate either by placing a pitot gage at discharge or by measuring the time to fill a container of known volume. See Table 3.

TABLE 3 - TIME FOR DISINFECTANT TO FLOW THROUGH 100 FT. OF PIPE - MINUTES			
PIPE DIAMETER (INCHES)	**@ 25 GPM**	**@ 100 GPM**	**@ 500 GPM**
2	0.7	0.2	0.04
4	2.6	0.7	0.13
6	5.9	1.5	0.3
8	10.5	2.6	0.5
10	16.3	4.1	0.8
12	23.5	5.9	1.2
14	32.0	8.0	1.6
16	41.8	10.5	2.1
18	52.9	13.2	2.7
24	94.0	23.5	4.7

4. Continue to apply chlorine solution until it reaches discharge. Check for the presence of chlorine at discharge by adding an orthotolidine reagent. In the presence of chlorine the reagent will turn red.

5. Maintain chlorinated water in the main for a minimum of 24 hours. At the end of this period chlorine concentration shall be at least 25 mg/1. Use high range test kit to determine concentration.

6. Operate all valves and hydrants to insure their proper disinfection.

7. Prevent back flow of super chlorinated water into existing distribution system.

E. Final Flushing:

1. After a 24-hour retention period, flush main until maximum chlorine concentration is 1.0 mg/1. Use DPD chlorine residual test kit.

2. Discharge super chlorinated water in a manner that will not adversely affect plants and animals. Comply with applicable State regulations for waste discharge.

F. Bacteriological Tests: Contact local health units for sampling criteria and procedures. Local health units may have more stringent criteria.

1. Test water main for bacteriological quality before putting pipe into service. A minimum of two successive sets of samples shall be taken at 24-hour intervals. Both sets of samples shall indicate bacteriological safe water before putting the facility in operation. Pay all expenses incurred for testing.

2. Tests shall be conducted by a laboratory approved by the New York State Health Dept.

G. Give all test results to Director's Representative.

1. Should test results prove any part of the system bacteriologically unsafe, repeat disinfection procedures until satisfactory results are obtained.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE