SPECIFICATIONS
FOR THE
BROWNING ROAD WATER TREATMENT PLANT IMPROVEMENTS

PREPARED FOR
MERCHANTVILLE-PENNSAUKEN
WATER COMMISION
CAMDEN COUNTY, NEW JERSEY
February 2025

REMINGTON & VERNICK ENGINEERS

2059 Springdale Road
Cherry Hill, NJ 08003
(856) 795-9595

RVE Project No. 0424M081

Dennis K. Yoder

Dennis K. Yoder, P.E., Lic. No. 31866

2-2-2025

Date

NOTICE TO BIDDERS

PUBLIC NOTICE IS HEREBY GIVEN that sealed bids will be received by the **Merchantville Pennsauken Water Commission** for the **Browning Road Water Treatment Plant Improvements Project** in the **Township of Pennsauken**, Camden County, New Jersey.

In general, this project consists of treatment improvements to the Browning Road Water Treatment Facility.

This contract or subcontract is expected to be funded in part with funds from the New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Trust. Neither the State of New Jersey, the New Jersey Environmental Infrastructure Trust nor any of their departments, agencies or employees is, or will be, a party to this contract or subcontract or any lower tier contract or subcontract. This contract or subcontract is subject to the provisions of N.J.A.C. 7:22-3, 4, 5, 9 and 10. The successful Bidder must comply with all the provisions of N.J.A.C. 7:22-9.1 et seq. for the participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals (SED).

Bid forms, contracts and specifications are available by contacting Remington & Vernick Engineers. Contact shall be made by phone or by email to make bid purchase arrangements. At 856 795 9595 or by submitting RVEbidinterest@rve.com.

Said Bids will be received, opened and read aloud in public at the **Merchantville Pennsauken Water Commission's Administrative Building located at 6751 Westfield Avenue, Pennsauken, Camden County, New Jersey on April 9th, 2025, at 11:00 AM. prevailing time.**

Electronic download link for copies of the bid forms, contracts and specifications may be obtained from said Remington and Vernick Engineers, by prospective bidders upon request, upon payment of the sum of $50.00 for each set. Should interested bidders not have the ability to handle electronic download sets, a set may be arranged to be sent overnight by calling 856 795 9595.

PAYMENT MUST BE RECEIVED PRIOR TO OBTAINING SAID SPECIFICATIONS, EITHER BY MAIL OR IN PERSON.

NO BIDS ARE TO BE DROPPED OFF AT THE ENGINEER'S OFFICE.

The **Water Commission** reserves the right to consider the bids for sixty (60) days after the receipt thereof, and further reserves the right to reject any or all bids, either in whole or in part and also to waive any informality in any and make such awards or take action as may be in the best interest of the **Water Commission**, in accordance with applicable law. N.J.A.C 7:22-9.7- In no case shall the advertisement for bids to be published less than 30 days prior to the date fixed for receiving bids on the purchase or contract

Bids must be on the bid form prepared by Remington and Vernick Engineers, in the manner designated therein and required by the specifications, must be enclosed in sealed envelopes bearing the name and address of the bidder on the outside and also bearing on the outside reference to the particular work bid upon. Said bids shall be addressed to **Merchantville Pennsauken Water Commission, 6751 Westfield Avenue, Pennsauken, New Jersey 08110**.

Each bid shall be accompanied by a certified check, cashier's check or bid bond duly executed by the bidder as principal and having as surety thereon a surety company listed on the Federal Treasury List (Environmental Protection Department Circular 570 Surety Companies Acceptable on Federal Bonds) as required by N.J.A.C. 7:22-3.17(g) and approved by the **Water Commission** in an amount not less than ten percent (10%) but in no case in excess of $20,000.00 of the amount bid. Any such bid bond shall be without endorsement or conditions. Bid shall also be accompanied by a certificate letter from a surety company stating that it will provide the bidder with the completion bond. In accordance with N.J.A.C.

7:22-9.10 the lowest bid resulting in a payment of unreasonable price. Bidders and the office shall be notified of the rejection of all bids, the reasons for the rejection, and the contracting agency's intent to solicit bids for a second time.

The award of the contract shall be made subject to the necessary moneys to do the work being provided by the **Water Commission** in a lawful manner. The contract to be executed by the successful bidder will provide that it shall not become effective until the necessary moneys to do the work have been provided by the **Water Commission** in a lawful manner. The award shall further be subjected to the securing of necessary State, Federal or Local permits governing the work. The invitation to bid is on an unrestricted basis whereby the successful bidder must fulfill the SED requirements.

Bidders are required to comply with the requirements of N.J.S.A. 10:5-31 et seq., N.J.A.C. 17:27 (Affirmative Action), N.J.S.A. 34:11-56.25 et seq.(New Jersey Prevailing Wage Act), and Americans with Disabilities Act of 1990 (42 U.S.C. S12101, et seq.).

Pursuant to N.J.A.C. 10:5-33, the contractor is further notified that he must comply with P.L. 1975, c. 127.

The contractor is further notified that he must comply with the provisions set forth in the N.J.S.A. 52:32-44 requiring New Jersey Business Registration and the collection of use taxes.

The contractor is further notified that he must comply with N.J.S.A. 52:25-24.2 and submit a Disclosure Statement listing stockholders with his bid.

The contractor is further notified that he must comply with N.J.S.A. 34:11-56.48 et seq. Public Works Contractor Registration Act and he and any subcontractors must be registered in accordance with the act.

The contractor is also further notified that he must comply with N.J.S.A. 52:32-44 and submit proof of business registration and submit proof of business registration for any named subcontractors in accordance with the act.

The contractor is also further notified that he must comply with P.L.2012 c.25 Disclosure of Investment Activities in Iran and must submit a Disclosure Statement listing activities in Iran with his bid.

This contract or subcontract is expected to be funded in part with funds from the New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Trust. Neither the State of New Jersey, the New Jersey Environmental Infrastructure Trust nor any of their departments, agencies, or employees is, or will be a party to this contract or subcontract or any lower tier contractor or subcontract.

Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals (SED):

This contract is subject to the provisions of N.J.A.C. 7:22-3, 4, 5, 9 and 10. In accordance with the provisions of N.J.S.A. 58:11B-26, N.J.A.C. 7:22-3.17(a) 24 and 4.17(a) 24, the contractor (subcontractor) shall comply with all of the provisions of N.J.A.C. 7:22-9 and ensure that no less than 10 percent of the total amount of all contracts related to the project shall be awarded to SEDs. Where the contractor (subcontractor) has an SED participation goal which exceeds 10 percent, the contractor's project SED goal shall take precedence. The Contractor shall comply with all of the provisions of N.J.A.C. 7:22-9.

This Notice shall appear in the Newspaper not less than ten (10) working days before the bid opening; and notice of revisions or addenda to advertisements or bid documents will be as outlined in N.J.S.A. 40A:11-23.

By Order of the Merchantville Pennsauken Water Commission
Camden County, New Jersey

Dated: March 10, 2025

PROPOSAL SECTION

BID DOCUMENT SUBMISSION CHECKLIST

Merchantville Pennsauken Water Commission
(Name of Local Contracting Unit)

Browning Road Water Treatment Plant Improvement — **0424M081**
(Name of Project) (Project or Bid Number)

A. Failure to submit the following documents is a mandatory cause for the bid to be rejected.
(N.J.S.A. 40A:11-23.2)

Required with Submission of Bid (Owner's checkmarks)		Initial Each Item Submitted With Bid (Bidder's Initials)
X	Bidder's acknowledgement of receipt of any notice(s) or revision(s) or addenda to an advertisement, specifications or bid document(s)	
X	A statement of ownership disclosure, pursuant to N.J.S.A. 52:25-24.2 (Stockholders Statement)	
X	A listing of subcontractors as required by N.J.S.A. 40A:11-16 (Subcontractor's Declaration)	
X	A bid guarantee as required by N.J.S.A. 40A:11-21 (Bid Bond, Certified Check or Cashier's Check)	
X	A certificate from a surety company, pursuant to N.J.S.A. 40A:11-22 (Consent of Surety)	

B. Failure to submit the following documents may be a cause for the bid to be rejected.
(N.J.S.A. 40A:11-23.1b.)

Required with Submission of Bid (Owner's checkmarks)		Initial Each Item Submitted With Bid (Bidder's Initials)
X	Public Works Contractor Registration Form	
X	New Jersey "Business Registration Certificate" Form	
X	Background Questionnaire	
X	Debarred List Affidavit	
X	Submission of a Non-Collusion Affidavit (this form must be notarized)	
X	Affirmative Action Requirements Form	
X	Bidder Certificate showing ability to perform contract, pursuant to N.J.S.A. 40A:11-20	

X	Prohibited Russia-Belarus Activities pursuant to P.L. 2022, c. 3.	
X	Certification of Non-Segregated Facilities Form	
X	Certification for American Iron and Steel Requirements of P.L. 112.76	
X	Certification of Equal Employment Opportunity	
X	Certification on Non-Debarment for Federal Government Contracts Form, pursuant to N.J.S.A. 52:32-44.1	
X	Lowest Bidder Prevailing Wage Certification pursuant to N.J.S.A. 34:11-56.25, et seq., N.J.A.C. 12.60-9.1	
X	Bid Form	

C. Owner's Statement with respect to N.J.S.A. 40:11-23.1c: See technical specifications whether uniformed law enforcement officers will or will not be required for traffic control.

D. SIGNATURE: The undersigned hereby acknowledges and has submitted the above listed requirements.

Name of Bidder: _____

By Authorized Representative:

Signature: _____

Print Name and Title: _____

Date: _____

Company Name: _____

Mailing Address: _____

Physical Address: _____

Phone Number : _____

Fax Number: _____

E-Mail: _____

ACKNOWLEDGEMENT OF RECEIPT OF CHANGES TO BID DOCUMENTS FORM

Merchantville Pennsauken Water Commission
(Name of Local Contracting Unit)

Browning Road Water Treatment Plant Improvements **0424M081**
(Name of Project) (Project or Bid Number)

Pursuant to N.J.S.A. 40A:11-23.1a., the undersigned bidder hereby acknowledges receipt of the following notices, revisions, or addenda to the bid advertisement, specifications or bid documents. By indicating date of receipt, bidder acknowledges the submitted bid takes into account the provisions of the notice, revision or addendum. Note that the local unit's record of notice to bidders shall take precedence and that failure to include provisions of changes in a bid proposal may be subject for rejection of the bid.

Local Unit Reference Number Or Title of Addendum/Revision		How Received (mail, fax, pick-up, etc.)	Date Received	Bidder's Initials
Notice, Revision or Addenda No.	Title or Description			

Acknowledged by bidder:

Name of Bidder: _____

By Authorized Representative:

Signature: _____

Printed Name and Title: _____

Date: _____

STATEMENT OF OWNERSHIP DISCLOSURE

N.J.S.A. 52:25-24.2 (P.L. 1977, c.33, as amended by P.L. 2016, c.43)

This statement shall be completed, certified to, and included with all bid and proposal submissions. Failure to submit the required information is cause for automatic rejection of the bid or proposal.

Name of Organization: _____

Organization Address: _____

_____

Part I Check the box that represents the type of business organization:

☐ Sole Proprietorship (skip Parts II and III, execute certification in Part IV)
☐ Non-Profit Corporation (skip Parts II and III, execute certification in Part IV)
☐ For-Profit Corporation (any type) ☐ Limited Liability Company (LLC)
☐ Partnership ☐ Limited Partnership ☐ Limited Liability Partnership (LLP)
☐ Other (be specific): _____

Part II

☐ The list below contains the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. (**COMPLETE THE LIST BELOW IN THIS SECTION**)

OR

☐ No one stockholder in the corporation owns 10 percent or more of its stock, of any class, or no individual partner in the partnership owns a 10 percent or greater interest therein, or no member in the limited liability company owns a 10 percent or greater interest therein, as the case may be. (**SKIP TO PART IV**)

(Please attach additional sheets if more space is needed):

Name of Individual or Business Entity	Address

Part III DISCLOSURE OF 10% OR GREATER OWNERSHIP IN THE STOCKHOLDERS, PARTNERS OR LLC MEMBERS LISTED IN PART II

If a bidder has a direct or indirect parent entity which is publicly traded, and any person holds a 10 percent or greater beneficial interest in the publicly traded parent entity as of the last annual federal Security and Exchange Commission (SEC) or foreign equivalent filing, ownership disclosure can be met by providing links to the website(s) containing the last annual filing(s) with the federal Securities and Exchange Commission (or foreign equivalent) that contain the name and address of each person holding a 10% or greater beneficial interest in the publicly traded parent entity, along with the relevant page numbers of the filing(s) that contain the information on each such person. **Attach additional sheets if more space is needed**.

Website (URL) containing the last annual SEC (or foreign equivalent) filing	Page #'s

Please list the names and addresses of each stockholder, partner or member owning a 10 percent or greater interest in any corresponding corporation, partnership and/or limited liability company (LLC) listed in Part II **other than for any publicly traded parent entities referenced above**. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member exceeding the 10 percent ownership criteria established pursuant to N.J.S.A. 52:25-24.2 has been listed. **Attach additional sheets if more space is needed.**

Stockholder/Partner/Member and Corresponding Entity Listed in Part II	Address

Part IV Certification

I, being duly sworn upon my oath, hereby represent that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I acknowledge: that I am authorized to execute this certification on behalf of the bidder/proposer; that the ***<name of contracting unit>*** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the completion of any contracts with ***<type of contracting unit>*** to notify the ***<type of contracting unit>*** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the, permitting the ***<type of contracting unit>*** to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):		Title:	
Signature:		Date:	

SUBCONTRACTOR DECLARATION

Each bidder shall set forth in the bid the names, addresses and license number (when required) of each subcontractor for the furnishing of plumbing, and gas fitting and all kindred work, and of the steam power plants, steam and hot water heating and ventilating and refrigeration apparatus and all kindred work, steam power plants and kindred work, and electrical work, including any electrical power plants, tele-data, fire alarm, or security system, and structural steel and ornamental iron work, if any, for the construction, alteration or repair of any public buildings.

A general contractor that intends to utilize a specific subcontractor to perform work in one or more of the specialty trade categories shall provide the required information with regard to that subcontractor in the appropriate space for each specialty trade category applicable to the contract

Whenever a bid sets forth more than one subcontractor for any of the categories listed below, the bidder shall submit to the contracting unit a certificate signed by the bidder listing each subcontractor named in the bid for that category. The certificate shall set forth the scope of work, goods and services for which the subcontractor has submitted a price quote and which the bidder has agreed to award to each subcontractor should the bidder be awarded the contract. The certificate shall be submitted to the contracting unit simultaneously with the list of the subcontractors. The certificate may take the form of a single certificate listing all subcontractors or, alternatively, a separate certificate may be submitted for each subcontractor. If a bidder does not submit a certificate or certificates to the contracting unit, the contracting unit shall award the contract to the next lowest responsible bidder.

All bidders seeking to perform plumbing work on a publicly bid contract are required to comply with N.J.S.A. 45:14C-2 and N.J.A.C. 13:32-1.3. These provisions require that plumbing work on such contract may only be performed by an entity in which a licensed master plumber owns not less than 10% of the issued and outstanding shares of stock in the corporation, or not less than 10% of the capital of the partnership, or not less than 10% of the ownership of any other firm or legal entity. Accordingly, if a bidder intends to perform plumbing work on a publicly bid contract with its own employees or by the bidder himself, a master plumber must possess an ownership interest that complies with N.J.S.A. 45:14C-2 and N.J.A.C. 13:32-1.3 in the entity submitting the bid. Alternately, if a bidder intends to perform such work through a subcontractor, a master plumber must possess an ownership interest that complies with N.J.S.A. 45:14C-2 and N.J.A.C. 13:32-1.3 in the subcontractor.

There shall be submitted proof that each subcontractor is qualified in accordance with the rules and regulations of the State of New Jersey when such rules and regulations exist.

A general contractor that intends to perform work in one or more of the specialty trade categories through the use of its own employees or the general contractor himself rather than through the utilization of a subcontractor shall write the word "**IN-HOUSE**" next to each applicable category and then insert the name, and license number where required, of each such employee of the general contractor or the general contractor himself in the appropriate spaces for each specialty trade category applicable to the contract.

If the contract does not involve the any of the specialty trade categories below, please insert the word "**NONE**" in each appropriate space provided.

Plumbing Work: _____

Name _____ Phone # _____
Address _____
License Number: _____

Gas Fitting and All Kindred Work: _____

Name _____ Phone # _____
Address _____
License Number: _____
Certification Number (for Medical Gas Piping Installation): _____

Steam Power Plants, Steam and Hot Water Heating and Ventilating and Refrigeration Apparatus and all Kindred Work:

Name _____ Phone # _____
Address _____
License Number: _____

Electrical Work, including any Electrical Power Plants _____

Name _____ Phone # _____
Address _____
License Number: _____

Tele-data Systems: _____

Name _____ Phone # _____
Address _____
License Number: _____
Telecommunications Exemption (Provide copy of letter and ID card) Number: _____

Fire Alarm Systems: _____

Name _____ Phone # _____
Address _____
License Number: _____
Fire Protection Equipment Business or Fire Protection Contractor Business Permit Number: _____

Security Systems: _____

Name _____ Phone # _____
Address _____
License Number: _____

Structural Steel and Ornamental Iron Work:

Name _____ Phone # _____
Address _____
License Number: Not Applicable

BID SECURITY

Attach bid bond, cashier's check or certified check in the amount of 10% of the bid, but not in excess of $20,000.00.

CONSENT OF SURETY

Attach Consent of Surety from a Surety Company, meeting the requirements, described herein, stating that if the bidder is awarded the contract that the surety company will supply the bonds for the contract.

1. Must be an irrevocable, unconditional commitment by the surety to issue on behalf of the bidder the bond or bonds set forth in the contract documents upon award of the project in the full amounts specified.
2. Must include all bonds required by the contract documents i.e. performance, labor and material payment, maintenance, environmental, etc.
3. Certificate (Consent) of Surety is not waiveable and will be considered a material defect resulting in rejection of bid if omitted from bid package.
4. Must not contain any provision that would serve to limit the surety's liability to the "spread to second" bidder in the event the bidder fails to enter into a contract upon award.

Sample wording is as shown below:

CONSENT OF SURETY

KNOW ALL MEN BY THESE PRESENTS, that for and consideration of the sum of $_____, lawful money of the United States of America, the receipt whereof is hereby acknowledged, paid the undersigned, and for other valuable consideration, the

_____ Insurance Company,

(Name)

_____

(Address)

existing under the laws of the State of New Jersey and licensed to do business in the State of New Jersey certifies and agrees, that if the contract for (Contracting Agency)_____
for: (Project)_____
is awarded to (Bidder)_____
the undersigned will execute the bond or bonds as required of the contract documents and will become Surety in the full amount set forth in the contract documents for the faithful performance of all obligations of the Bidder, provided however, that this commitment shall expire sixty (60) days from the bid opening, unless agreed upon by Bidder, Owner and Surety to be extended.

Signed, sealed and dated this _____ day of _____ , 20_____ .

_____ INSURANCE COMPANY
(Name)

By _____
(Name)
Attorney in Fact

(To be accompanied by the usual proof of Authority of Officers of officers of the Surety Company to execute same)

PUBLIC WORKS CONTRACTOR REGISTRATION FORM

N.J.S.A. 34:11-56.48 requires that contractors and subcontractors, be registered with the New Jersey Department of Labor, Division of Wage and Hour Compliance. The definition in the law is as follows:

"Contractor means a person, partnership, association, joint stock company, trust, corporation, or other legal business entity or successor thereof who enters into a contract which is subject to the provisions of the "New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et seq. and includes any subcontractor or lower tier subcontractor of a contractor as defined herein."

1. All named contractors in a bid proposal (including out-of-state contractors) must be registered with the Department of Labor's Division of Wage and Hour Compliance at the time proposals are received by the public entity.
2. All named sub-contractors must be registered with the Department of Labor pursuant to the PWCRA at the time the proposal is received, or the proposal will be determined to be non-responsive.
3. Any non-listed sub-contractor must be registered with the Department of Labor prior to physically starting work.
4. The law requires contractors to submit certificates after a bid proposal is received and prior to awarding the contract. (N.J.S.A. 34:11-56.55)
5. After bid proposals are received, and prior to contract award, the contractor must submit to the public entity copies of certifications of all listed sub-contractors.
6. Prior to the work being performed by non-listed subcontractors, the contractor must submit to the public entity copies of certifications of all non-listed subcontractors.

Please indicate below, for the bidder and all subcontractors listed on the "Subcontractor Declaration" herein, as to their registration with the NJ Department of Labor, Division of Wage and Hour Compliance in accordance with N.J.S.A. 34:11-56.48.

Name	Not Registered	Registration Number
Bidder_____	___	_____
(Subcontractor)_____	___	_____
(Subcontractor)_____	___	_____
(Subcontractor)_____	___	_____
(Subcontractor)_____	___	_____

Subscribed and sworn
before me this _____ day
of _____ 20 ___.

_____ _____
Signature

Notary Public of _____ _____
Name and Title

My Commission Expires _____, 20_____. (Type or Print)

(Seal)

NEW JERSEY ”BUSINESS REGISTRATION CERTIFICATE” FORM

N.J.S.A. 52:32-44 requires that Business Organization’s, be registered with the New Jersey Department of Treasury, Division Revenue. The definition in the law is as follows:

“"Contractor" means a business organization that seeks to enter, or has entered into, a contract with a contracting agency;

“Contract” means any agreement, including but not limited to a purchase order or a formal agreement for the provision of goods, performance of services, or construction of a construction project, which is a legally binding relationship enforceable by law, between a contractor and a contracting agency that agrees to compensate the contractor, as defined by and subject to the terms and conditions of the agreement; and where the goods that are received, services that are delivered, and construction that is constructed is within the geographic borders of the State of New Jersey; and where:

(1) the value of a single contract with the contractor is in excess of 15 percent of the amount of the contracting agency’s bid threshold; or

(2) when the aggregate amount of contracts with the contractor, during the fiscal year of the contracting agency, exceeds 15 percent of the amount of the contracting agency’s bid threshold.

Please indicate below, for the bidder and all subcontractors listed on the “Subcontractor Declaration” herein, as to their registration with the NJ Department of Treasury, Division of Revenue in accordance with N.J.S.A. 52:32-44.

The contractor shall provide the contracting agency with the business registration certificate of the contractor and that of any named subcontractor prior to the time a contract, purchase order, or other contracting document is awarded or authorized.

Name	Not Registered	Registration Number
Bidder_____	___	_____
(Subcontractor)_____	___	_____
(Subcontractor)_____	___	_____
(Subcontractor)_____	___	_____
(Subcontractor)_____	___	_____

Subscribed and sworn
before me this _____ day
of _____ 20 ___.

_____ _____
Signature

Notary Public of _____ _____
Name and Title
(Type or Print)

My Commission Expires _____, 20_____.

(Seal)

BACKGROUND QUESTIONNAIRE

In accordance with paragraph entitled "Qualifications of Bidders" of "Information for Bidders", provide the following information:

Date of Organization of Company _____

Name and address of officers: _____

President _____
Vice President _____
Secretary _____
Treasurer _____

EXPERIENCE

1. How many years has your organization been in business as a general contractor under your present business name? _____

2. How many years experience in this type of construction work has your organization had? _____

3. What are the latest projects (within the last five years) your organization has completed? (Attach additional pages if necessary)

	Contract Amount	Date Work Completed	For Whom
A.	$_____	_____	_____
B.	$_____	_____	_____
C.	$_____	_____	_____
D.	$_____	_____	_____
E.	$_____	_____	_____

Names, Addresses and Telephone Numbers of Reference for items listed above:

	Name and Address	Telephone No.
A.	_____	_____
B.	_____	_____
C.	_____	_____

	Name and Address	Telephone No.
D.	_____	_____
E.	_____	_____

4. Have you ever failed to complete any work awarded to you (within the last ten years)?_____
If so, where and why?_____
_____

5. Have you or has any officer of your organization ever been an officer or partner of some other contracting organization that failed to complete any work (within the last ten years) ?_____
If so, state the name of individual, position and the name of the other organization
_____

_____

Did this other contracting organization ever fail to complete any work awarded it (within the last ten years)? _____
If so, where and why?_____

6. Give list of uncompleted contracts at present held by you:

Name of Contract	Contracting Agency	Amount
_____		$_____
_____		$_____
_____		$_____

Name of Contract	Contracting Agency	Amount
_____		$_____
_____		$_____

7. State approximately the largest amount of work you have done in any one year (within the last five years) of a similar nature to the work being bid on.

_____

_____

8. List the equipment available for the performance of work under the proposed contract (attach additional sheets if necessary)

_____

_____

_____

_____

_____

_____

DEBARRED LIST AFFIDAVIT

STATE OF _____

COUNTY OF _____ ss:

I, _____ of the City/Town/Township/Borough, etc. _____ in the County of _____ and the State of _____full age, being duly sworn according to law on my oath depose and say that:
I am _____ an officer of the firm of _____ _____ the bidder making the bid for the above named work, and that I executed said bid with full authority to do so; that said bidder at the time of making of this bid is not debarred at the federal level from contracting with a federal government agency as indicated in N.J.S.A. 52:32-44.1 or included on the State of New Jersey, State Treasurer's List of Debarred, Suspended and Disqualified Bidders; and that all statements contained in said bid and in this affidavit are true and correct, and made with the full knowledge that the _____ ,
(name of the contracting agency)
as the Owner relies upon the truth of the statements contained in said bid and in the statements contained in this affidavit in awarding the contract for said work.

The undersigned further warrants that should the name of the firm making this bid be debarred at the federal level from contracting with a federal government agency or appear on the State Treasurer's List of Debarred, Suspended and Disqualified Bidders at anytime prior to, and during the life of this Contract, including Guarantee Period, that the Local Unit shall be immediately so notified by the signatory of this Eligibility Affidavit.

The undersigned understands that the firm making the bid as Contractor is subject to debarment, suspension and/or disqualification in contracting with the State of New Jersey, if the Contractor, pursuant to N.J..A.C. 12:60-7.1 et seq., commits any of the acts listed therein, and as determined according to applicable law and regulation.

_____

_____

_____
(Insert Name, Telephone No., Fax No. and Address of Contractor)

_____
(Insert Name and Title of Affiant)

Subscribed and sworn
before me this _____ day
of _____ 20 __ .

_____

Notary Public of _____

My Commission Expires _____ , 20 ___.

(Seal)

NON-COLLUSION AFFIDAVIT

STATE OF _____

COUNTY OF _____ ss:

I, _____ of the (City, Town, Township, Borough, etc.)

of _____ in the County of _____ and the

State of _____, of full age, being duly sworn

according to law on my oath depose and say that:

I am _____
of the firm of _____
the bidder making the Proposal for the above named project, and that I executed the said Proposal with full authority to do so; that said bidder had not, directly or indirectly, entered into any agreement(s), participated in any collusion, or otherwise taken any action in restraint of free, competitive bidding in connection with the above named project; and that all statements contained in said Proposal and in this affidavit are true and correct, and made with full knowledge that the _____ relies upon the truth of the statements
(name of contracting agency)
contained in said Proposal and in this affidavit in awarding the contract for the said Project.

I further warrant that no person(s) or selling agency has been employed or retained to solicit, or secure such contract upon an agreement or understanding for a commission, percentage, brokerage or contingent, fee except bona fide employees or bona fide established commercial or selling agencies maintained by

_____.
(name of bidder)

_____

_____

_____
(Insert Name, Telephone No., Fax No. and Address of Contractor)

_____
(Insert Name and Title of Affiant)

Subscribed and sworn
before me this _____ day
of _____ 20 __ .

_____

Notary Public of _____

My Commission Expires _____ , 20 ___.
(Seal)

AFFIRMATIVE ACTION REQUIREMENTS
(CONSTRUCTION CONTRACTS)

A. This contract is subject to and all bidders are required to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27; Affirmative Action Regulations.

B. For any violations of this law in addition to all other penalties allowable by law, the violator shall be subject to a fine up to $1,000.00 for each violation for each day during which the violation continues, as delineated in N.J.A.C. 17:27-10.6, with said fine to be collected in a summary manner pursuant to the "Penalty Enforcement Law of 1999" (N.J.S.A. 2A:58-10 et seq.) (P.L. 1975, C127, Para. 5b) (N.J.A.C. 17:27).

C. ALL CONTRACTORS

1. All contractors shall complete and submit the Initial Project Workforce Report Form AA-201 and AA-202 (https://www.nj.gov/treasury/contract_compliance/) upon notification of award. Proper completion and submission of this report shall constitute evidence of the contractor's compliance with the regulations.

2. Failure to submit the form may result in the contract being terminated.

3. The contractor also agrees to submit a copy of the Monthly Project Workforce Report Form AA-202, once a month thereafter for the duration of the contract to the Division of Contract Compliance and to the Public Agency Compliance Officer.

The undersigned contractor certifies that he is aware of the commitment to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 and agrees to furnish the required documentation pursuant to the Law.

COMPANY: _____

SIGNATURE: _____

TITLE _____

NOTE: A contractor's bid must be rejected as non-responsive if a contractor fails to comply with therequirementsofN.J.S.A.10:5-31 et seq. andN.J.A.C.17:27.

CERTIFICATE OF BIDDER SHOWING ABILITY TO PERFORM CONTRACT

STATE OF _____

COUNTY OF _____ ss:

I, _____ of the (City, Town, Township, Borough, etc.)

of _____ in the County of _____ and the

State of _____ of full age, being duly sworn

according to law on my oath depose and say that:

1. I am a(n) owner, partner, shareholder or officer of the company set forth below and am duly authorized to execute this affidavit on its behalf.

(Check appropriate Statement(s))

_____ I own, lease or control the necessary equipment required by the plans, specifications, and advertisements under which bids are asked for.

_____ I do not own, lease or control all the necessary equipment required by the plans, specifications, and advertisements under which bids are asked for.
If the bidder is not the actual owner or lessee of all the necessary equipment provide the source from which the equipment will be obtained (Attach additional sheets if necessary)

_____

_____

_____

(Attach certification from the owner or person in control of the equipment definitely granting to the bidder the control of the equipment required during such time as may be necessary for the completion of that portion of the contract for which it is necessary)

_____

_____

_____
(Insert Name, Telephone No., Fax No. and Address of Contractor)

_____
(Insert Name and Title of Affiant)

Subscribed and sworn
before me this _____ day
of _____ 20 __ .

_____

Notary Public of _____

My Commission Expires _____ , 20 ___.
(Seal)

PROHIBITED RUSSIA-BELARUS ACTIVITIES

Person or Entity: _____

Part 1: Certification

COMPLETE PART 1 BY CHECKING **ONE OF THE THREE BOXES BELOW**

Pursuant to law, any person or entity that is a successful bidder or proposer, or otherwise proposes to enter into or renew a contract, for goods or services must complete the certification below prior to contract award to attest, under penalty of perjury, that neither the person or entity, nor any parent entity, subsidiary, or affiliate, is identified on the Department of Treasury's Russia-Belarus list. Before a contract for goods or services can be amended or extended, a person or entity must certify that neither the person or entity, nor any parent entity, subsidiary, or affiliate, is identified on the Department of Treasury's Russia-Belarus list. The list is found on Treasury's website at the following web address:

https://www.nj.gov/treasury/administration/pdf/RussiaBelarusEntityList.pdf

As applicable to the type of contract, the above-referenced list must be reviewed prior to completing the below certification.

A person or entity unable to make the certification must provide a detailed, accurate, and precise description of the activities of the person or entity, or of a parent entity, subsidiary, or affiliate, engaging in prohibited activities in Russia or Belarus. The person or entity must cease engaging in any prohibited activities and provide an updated certification before the contract can be entered into.

If a vendor or contractor is found to be in violation of law, action may be taken as appropriate and as may be provided by law, rule, or contract, including but not limited to imposing sanctions, seeking compliance, recovering damages, declaring the party in default, and seeking debarment or suspension of the party.

CONTRACT AWARDS AND RENEWALS

☐ I certify, pursuant to law, that neither the person or entity listed above, nor any parent entity, subsidiary, or affiliate appears on the N.J. Department of Treasury's lists of entities engaged in prohibited activities in Russia or Belarus pursuant to P.L. 2022, c. 3. I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf. (Skip Part 2 and sign and complete the Certification below.)

CONTRACT AMENDMENTS AND EXTENSIONS

☐ I certify, pursuant to law, that neither the person or entity listed above, nor any parent entity, subsidiary, or affiliate is listed on the N.J. Department of the Treasury's lists of entities determined to be engaged in prohibited activities in Russia or Belarus pursuant to P.L. 2022, c. 3. I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf. (Skip Part 2 and sign and complete the Certification below.)

IF UNABLE TO CERTIFY

☐ I am unable to certify as above because the person or entity and/or a parent entity, subsidiary, or affiliate is listed on the Department's Russia-Belarus list. I will provide a detailed, accurate, and precise description of the activities as directed in Part 2 below, and sign and complete the Certification below. Failure to provide such will prevent the award of the contract to the person or entity, and appropriate penalties, fines, and/or sanctions will be assessed as provided by law.

Part 2: Additional Information

PLEASE PROVIDE FURTHER INFORMATION RELATED TO PROHIBITED ACTIVITIES IN RUSSIA OR BELARUS.

You must provide a detailed, accurate, and precise description of the activities of the person or entity, or of a parent entity, subsidiary, or affiliate, engaging in prohibited activities in Russia or Belarus in the space below and, if needed, on additional sheets provided by you.

_____

_____

_____

_____

_____

_____

Part 3: Certification of True and Complete Information

I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments there, to the best of my knowledge, are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity.

I acknowledge that the <**Name of Contracting Unit**> is relying on the information contained herein and hereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the <**Name of Contracting Unit**> to notify the <**Name of Contracting Unit**> in writing of any changes to the answers of information contained herein.

I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification. If I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the <**Name of Contracting Unit**> and that the <**Name of Contracting Unit**> at its option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name :_____ **Title:**_____
(Print)

Signature :_____ **Date:**_____

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to contracts, subcontracts, and agreements with Applicants who are themselves performing federally assisted construction contracts, exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause.)

The Federally assisted Construction Contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The Federally assisted Construction Contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The Federally assisted Construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certificate, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation and entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color or national origin, because of habit, local custom, or otherwise. The Federally assisted Construction Contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000.00 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certifications in his files.

_____ _____
(Signature) (Date)

_____
(Name and Title of Signer – Please Type)

NOTE: Penalty for making false statements in offers as prescribed in 18 U.S.C. 1001.

CERTIFICATION FOR
AMERICAN IRON AND STEEL REQUIREMENTS OF P.L. 113-76
CONSOLIDATED APPROPRIATION ACT, 2014

The Bidder acknowledges to and for the benefit of the **Merchantville Pennsauken Water Commission** ("Owner") and the State of New Jersey ("the State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Bidder pursuant to this Agreement. The Bidder hereby represents and warrant to and for the benefit of the Owner and the State that (a) the Bidder has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Bidder will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Owner or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Bidder shall permit the Owner or State to recover as damages against the Bidder any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Owner). While the Bidder has no direct contractual privity with the State, as a lender to the Owner for the funding of this project, the Owner and the Bidder agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

_____ _____

Date Signature

AFFIRMATIVE ACTION AFFIDAVIT
N.J.S.A. 10:5-31 ET SEQ,
(To be completed by firms with less than 50 employees)

STATE OF NEW JERSEY)
COUNTY OF) SS:

I, _____, of the (City, Town, Borough) of _____
in the County of _____ and the State _____, of full age, being duly sworn according to law on my oath depose and say that:

1. I am (President, Partner, Owner) of the firm of, _____, a bidder making a proposal upon the above named project.

2. _____ does not have 50 employees or more inclusive of all officers and employees of every type.

3. I am familiar with the affirmative action requirements of PL 1975, c.127 and rules and regulations issued by the Treasurer, State of New Jersey, pursuant thereto.

4. _____ has complied with all the affirmative action requirements of the State of New Jersey, including those required by N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 and the rules and regulations issued by the Treasurer, State of New Jersey, pursuant thereto.

5. I am aware that if _____ does not comply with N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 and rules and regulations issued pursuant thereto, that no monies will be paid by the State of New Jersey, County of _____, (City, Town, Borough) of _____, until an affirmative action plan is approved. I am also aware that the contract may be terminated and _____ may be debarred from all public contracts for a period of up to five (5) years.

6. In the event my workforce increases to 50 employees, I must contact the State Affirmative Action Office and complete and Employee Information Report (AA-302).

_____
Signature of Authorized Representative

_____
Name and Title

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

CERTIFICATION OF EQUAL EMPLOYMENT OPPORTUNITY

By The submission of this bid and in accordance with Executive Order No. 11246, Section 202, dated September 24, 1965, the bidder, offeror, applicant, or subcontractor certifies that he shall not discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

HIRING, PLACEMENT UPGRADING, TRANSFER OR DEMOTION, RECRUITMENT, ADVERTISING, OR SOLICITION, FOR EMPLOYMENT, TRAINING DURING EMPLOYMENT, RATES OF PAY OR OTHER FORMS OF COMPENSATION, SELECTION FOR TRAINING INCLUDING APPREHENSHIP, LAYOFF, OR TERMINATION.

He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontractors exceeding $10,000, which are not exempt from the provision of Equal Opportunity clause: that he will retain such certifications in his files, and that he will post in a conspicuous place and forward Notice of Non-Discrimination to such proposed subcontractors (except where the proposed subcontractors have submitted identical certification for specific time periods).

_____ _____

(Signature) (Date)

_____

(Name and Title of Signer – Please type)

CERTIFICATION OF NON-DEBARMENT
FOR FEDERAL GOVERNMENT CONTRACTS
N.J.S.A. 52:32-44.1 (P.L. 2019, c.406)

This certification shall be completed, certified to, and submitted to the contracting unit prior to contract award, except for emergency contracts where submission is required prior to payment.

PART I: VENDOR INFORMATION	
Individual or Organization Name	
Address of Individual or Organization	
Unique Entity ID (if applicable)	
CAGE Code (if applicable)	
Check the box that represents the type of business organization:	

□Sole Proprietorship (skip Parts III and IV) □Non-Profit Corporation (skip Parts III and IV)

□For-Profit Corporation (any type) □Limited Liability Company (LLC) □Partnership

□Limited Partnership □Limited Liability Partnership (LLP)

□Other (be specific): _____

PART II – CERTIFICATION OF NON-DEBARMENT: Individual or Organization			
I hereby certify that the **individual or organization listed above in Part I** is not debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the ***<name of contracting unit>*** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by ***<type of contracting unit>*** to notify the ***<type of contracting unit>*** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the ***<type of contracting unit>***, permitting the ***<type of contracting unit>*** to declare any contract(s) resulting from this certification void and unenforceable.			
Full Name (Print):		Title:	
Signature:		Date:	

PART III – CERTIFICATION OF NON-DEBARMENT: Individual or Entity Owning Greater than 50 Percent of Organization	
Section A (Check the Box that applies)	
☐	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of its voting stock, or of the partner in the partnership who owns more than 50 percent interest therein, or of the member of the limited liability company owning more than 50 percent interest therein, as the case may be.
Name of Individual or Organization	
Physical Address	
OR	
☐	No one stockholder in the corporation owns more than 50 percent of its voting stock, or no partner in the partnership owns more than 50 percent interest therein, or no member in the limited liability company owns more than 50 percent interest therein, as the case may be.
Section B (Skip if no Business entity is listed in Section A above)	
☐	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of the voting stock of the organization's parent entity, or of the partner in the partnership who owns more than 50 percent interest in the organization's parent entity, or of the member of the limited liability company owning more than 50 percent interest in organization's parent entity, as the case may be.
Stockholder/Partner/Member Owning Greater Than 50 Percent of Parent Entity	
Physical Address	
OR	
☐	No one stockholder in the parent entity corporation owns more than 50 percent of its voting stock, no partner in the parent entity partnership owns more than 50 percent interest therein, or no member in the parent entity limited liability company owns more than 50 percent interest therein, as the case may be.

Section C – Part III Certification			
I hereby certify that no individual or organization that is debarred by the federal government from contracting with a federal agency owns greater than 50 percent of the **Organization listed above in Part I** or, if applicable, owns greater than 50 percent of a parent entity of _____. (**name of organization**) I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the **<*name of contracting unit*>** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award **<*type of contracting unit*>** to notify the **<*type of contracting unit*>** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the **<*type of contracting unit*>**, permitting the **<*type of contracting unit*>** to declare any contract(s) resulting from this certification void and unenforceable.			
Full Name (Print):		Title:	
Signature:		Date:	

Part IV – CERTIFICATION OF NON-DEBARMENT: Contractor – Controlled Entities		
Section A		
☐	Below is the name and address of the corporation(s) in which the **Organization listed in Part I** owns more than 50 percent of voting stock, or of the partnership(s) in which the **Organization listed in Part I** owns more than 50 percent interest therein, or of the limited liability company or companies in which the **Organization listed above in Part I** owns more than 50 percent interest therein, as the case may be.	
Name of Business Entity		**Physical Address**
Add additional sheets if necessary		
OR		
☐	The **Organization listed above in Part I** does not own greater than 50 percent of the voting stock in any corporation and does not own greater than 50 percent interest in any partnership or any limited liability company.	

Section B (skip if no business entities are listed in Section A of Part IV)	
☐	Below are the names and addresses of any entities in which an entity listed in Part III A owns greater than 50 percent of the voting stock (corporation) or owns greater than 50 percent interest (partnership or limited liability company).

Name of Business Entity Controlled by Entity Listed in Section A of Part IV	Physical Address

Add additional Sheets if necessary

OR

☐	No entity listed in Part III A owns greater than 50 percent of the voting stock in any corporation or owns greater than 50 percent interest in any partnership or limited liability company.

Section C – Part IV Certification

I hereby certify that the **Organization listed above in Part I** does not own greater than 50 percent of any entity that that is debarred by the federal government from contracting with a federal agency and, if applicable, does not own greater than 50 percent of any entity that in turns owns greater than 50 percent of any entity debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the **<*name of contracting unit*>** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by **<*type of contracting unit*>** to notify the **<*type of contracting unit*>** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the **<*type of contracting unit*>**, permitting the **<*type of contracting unit*>** to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):		Title:	
Signature:		Date:	

LOWEST BIDDER PREVAILING WAGE CERTIFICATION

In the matter of an award of a contract for public work for a project described as:	)	STATE OF NEW JERSEY
	)	DEPARTMENT OF LABOR AND
	)	WORKFORCE DEVELOPMENT
	)	DIVISION OF
[Enter project name]	)	WAGE & HOUR COMPLIANCE
	)	
	)	
	)	Certification of Lowest Bidder

_____, of full age and under oath, duly provides the following sworn statement:

(1). I am the owner and/or highest-ranking official or officer of a company or firm named_____, which holds a currently valid public works contractor registration pursuant to the New Jersey Public Works Contractor Registration Act, N.J.S.A. 34:11-56.48 et seq., certificate number_____.

(2). I submitted a bid for a contract award in the above identified project and the public body has informed me that I am the lowest bidder by 10 percent or more as compared to the next lowest bid submitted.

(3). The amount of my bid does include paying the prevailing wage rate to all workers who perform work on the project at rates of pay, including both base wage and fringe benefits, set forth in applicable Wage Determinations, (1) for the appropriate locality, (2) for the appropriate work classification (e.g., carpenter, electrician, mason, plumber), and (3) for the appropriate job title (e.g., Apprentice, Journeyman, Forman), published by the New Jersey Department of Labor and Workforce Development (NJDOL) pursuant to the New Jersey Prevailing Wage Act (NJPWA), N.J.S.A. 34:11-56.25 et seq., and corresponding NJDOL rules, N.J.A.C. 12:60.

I certify under penalty of perjury that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are false, I am subject to punishment. See N.J.S.A. 2C:28-1 et seq., specifically, N.J.S.A. 2C:28-3, within the New Jersey Code of Criminal Justice.

Dated:_____ Signature:_____

Title: _____

BID FORM

Pursuant to and in compliance with your Advertisement for Bids and the Information for Bidders relating thereto, the undersigned hereby offers to furnish all plant, labor, materials, supplies, equipment and other facilities and things necessary for, or proper for, or incidental to the BROWNING ROAD WATER TREATMENT PLANT IMPROVEMENTS, as required by, and in strict accordance with the applicable provisions of plans and specifications and all addenda issued by the MERCHANTVILLE PENNSAUKEN WATER COMMISSION or its Engineer prior to the date of opening the bids, whether received by the

NOTE: Extension of Unit Prices must be exact.

BASE BID

Item	Quantity	Units	Description	Unit Price	Amount
1	1	LS	MOBILIZATION & DEMOBILIZATION (MAX. 3% PER N.J.A.C. 7:14-2.9)	$	$
2	1	LS	ENVIRONMENTAL AND CULTURAL RESOURCE PROTECTION AND RESTORATION	$	$
3	1	LS	SOIL EROSION AND SEDIMENT CONTROL	$	$
4	1	LS	SITE DEMOLITION, COMPLETE	$	$
5	1	LS	SITE CLEARING, ROUGH GRADING, EXCAVATION, HAULING AND GRADING COMPLETE	$	$
6	2	UN	TEST PIT CONVENTIONAL	$	$
7	1	UN	TEST PIT SOFT DIG	$	$
8	1	LS	CMU TREATMENT BUILDING , COMPLETE	$	$
9	1	LS	SITE PIPING, VALVES FITTINGS HYDRANTS AND APPURTENANCES, COMPLETE	$	$

Item	Quantity	Units	Description	Unit Price	Amount
10	1	LS	GRANULAR ACTIVATED CARBON TREATMENT SYSTEM INSTALLATION, COMPLETE	$	$
11	1	LS	ADVANCED OXIDATION PROCESS, INCLUDING HYDROGEN PEROXIDE FEED SYSTEM AND UV DISINFECTION SYSTEM, COMPLETE	$	$
12	1	LS	CHEMICAL TANKS AND FEED SYSTEMS INCLUDING INSTALLATION, COMPLETE	$	$
13	1	LS	PROCESS PIPING, VALVES FITTINGS AND APPURTENANCES, COMPLETE	$	$
14	1	LS	INSTRUMENTATION AND CONTROL SYSTEM, COMPLETE	$	$
15	1	LS	SUPPLY AND INSTALLATION OF HIGH SERVICE BOOSTER PUMPING, EQUIPMENT AND UPGRADES, COMPLETE	$	$
16	1	LS	AUXILIARY POWER GENERATOR SET AND ASSOCIATED EQUIPMENT , COMPLETE	$	$
17	1	LS	ALL MECHANICAL WORK FOR THE NEW TREATMENT BUILDING, INCLUDING HEATING AND VENTILATING SYSTEMS AND DEHUMIFICATION SYSTEM, COMPLETE	$	$
18	1	LS	ALL ELECTRICAL WORK FOR THE TREATMENT BUILDING IMPROVEMENTS , COMPLETE	$	$

Item	Quantity	Units	Description	Unit Price	Amount
19	1	LS	ALL COLD AND HOT WATER PLUMBING WORK FOR THE TREATMENT BUILDING IMPROVEMENTS AND ACCESSORIES, COMPLETE	$	$
20	1	LS	START-UP, TESTING AND PLACING THE NEW TREATMENT FACILITY INTO PERMANENT SERVICE , COMPLETE	$	$
21	1	LS	INSTALLATION OF NEW SEWER LINE, COMPLETE	$	$
22	1	LS	FINAL SITE RESTORATION AND LANDSCAPING, COMPLETE	$	$
23	1	LS	PROVIDE AND INSTALL BUILDING LIGHTNING PROTECTION, COMPLETE	$	$
24	1	LS	ALLOWANCE FOR SCADA INTEGRATION, COMPLETE	$ 150,000.00	$ 150,000.00
25	1	LS	ALLOWANCE FOR COORDINATION WITH PSE&G FOR GAS LINE RELOCATION AND MISCELLENEOUS FEES	$ 40,000.00	$ 40,000.00
26	1	LS	ALLOWANCE FOR COORDINATION WITH PSE&G FOR POLE AND ELECTRICAL LINE RELOCATION, SUPPLY AND INSTALLATION OF TRANSFORMER AND MISCELLENEOUS FEES	$ 50,000.00	$ 50,000.00
27	1	LS	ALLOWANCE FOR UNFORSEEN CONDITIONS	$ 100,000.00	$ 100,000.00
			TOTAL CONSTRUCTION COST, BASE BID Items #1 - #27, Inclusive	$	

Item	Quantity	Units	Description	Unit Price	Amount
			TOTAL AMOUNT BID WRITTEN OUT		
			SIGNATURE	**NAME & TITLE**	
			BID DATE	**COMPANY NAME**	

TABLE OF CONTENTS
INFORMATION FOR BIDDERS

INFORMATION FOR BIDDERS

1.0 BID PREPARATION

1.01 EXAMINATION AND RESPONSIBILITY

Bidders are directed to examine for themselves the drawings, specifications, estimated quantities and the location of the proposed work. They shall exercise their own judgment as to the scope and nature of the work; the difficulties to be encountered and the quantities that may actually be encountered in the work. Each bidder is fully responsible for having reviewed and understood these specifications previous to submitting his bid, that his bid covers and complies with all requirements of the Contract Documents, and shall not at any time thereafter assert any claim related to any misunderstanding of the nature or amount of work to be done.

1.02 CONDITION OF WORK

Each bidder must inform himself fully of the conditions relative to the construction under which the work is now being or will be performed. Failure to do so will not relieve a successful bidder of his obligation to furnish all materials and labor necessary to carry out the provisions of the contract documents and to complete the contemplated work for the construction as set forth in his bid. The Contractor in the carrying out of his work must employ such methods or means that will not cause any interruptions or interference with the work of any other contractor (if applicable).

1.03 OBLIGATIONS OF BIDDERS

At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the drawings and contract documents (including all addenda). The failure or omission of any bidder to receive or examine any form, instrument or documents, shall in no way relieve any bidder from any obligations contained therein.

1.04 ADDENDA, BID SPECIFICATION CHALLENGES AND INTERPRETATIONS

The Table of Contents indicates the number of pages of each section of the document. If any bidder finds that a page was miss-copied or is missing, please contact the Engineer. The page(s) will be faxed to the bidder. Issuance of any such pages will not be considered an Addendum to the contract or specifications.

No interpretations of the meaning of the drawings, specifications or other contract documents will be made to any bidder orally. Every request for such interpretation should be made in writing, addressed to the Engineer, and to be given consideration, must be received at least ten (10) days prior to the final date fixed for receiving bids. Any and all such interpretations and/or supplemental instructions will be in the form of written addenda to the specifications, which if issued, will be issued in accordance with applicable State Laws, including but not limited to N.J.S.A. 40A:11-23 c. 2). For all construction work, notice shall be provided no later than seven days, Saturdays, Sundays, or holidays excepted, prior to the date for acceptance of bids.

Any bidder who wishes to challenge a bid specification shall file such challenges in writing with the Engineer no less than three business days prior to the opening of the bids. Challenges filed after that time shall be considered void and having no impact on the contracting unit or the award of a contract.

Failure of any bidder to receive any such addendum or interpretations shall not relieve any bidder from any such obligations therein under his bid submitted. All addenda so issued shall become part of the contract documents, and shall be attached to the bid form when submitted

Pursuant to N.J.A.C. 10:5-33: "Bidders are required to comply with requirements of P.L. 1975, c. 127.

(a) It has long been the policy of the State of New Jersey to promote equal employment opportunity by prohibiting discrimination in employment and requiring affirmative action in the performance of contracts funded by the State. That policy was reinforced and expanded by an act of the Legislature, signed into law by the Governor, June 23, 1975. The statute, N.J.S.A. 10:5-31 et seq., (P.L. 1975, c. 127) provides that no public works contracts can be awarded nor any moneys paid until the prospective contractor has agreed to contract performance which complies with an approved affirmative action program. The law applies to each political subdivision and agency of the State and encompasses contracts for goods and services including professional services, and construction contracts.

(b) These rules establish the affirmative action employment practices necessary for public agencies, contractors, subcontractors, and business firms to comply with the equal employment opportunity standards of N.J.S.A. 10:5-31 et seq. To assure effective implementation of the equal employment opportunity and affirmative action requirements of N.J.S.A. 10:5-31 et seq., these rules prescribe procedures designed to minimize administrative paperwork, delays and unproductive red-tape.

1.05 QUALIFICATIONS OF BIDDERS

The owner may make such investigation as is necessary to determine the responsibility of the bidder and/or the ability of the bidder to perform the work. The bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that said bidder is responsible or properly qualified to carry out the obligations of the contract and to complete the work therein contemplated.

Conditional bids will not be accepted. Bids which are incomplete or obscure may be rejected at Owner's option.

1.06 DISCLOSURE STATEMENT N.J.S.A. 52:25-24.2

No corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipality or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or accompanying the bid, of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding 10 percent or more of that corporation's stock, or the individual partners owning 10 percent or greater interest in that partnership, or the members owning 10 percent or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be

continued until names and addresses of every noncorporate stockholder, and individual partner, and member, exceeding the 10 percent ownership criteria established in this act, has been listed.

To comply with this section, a bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest.

1.07 MANUFACTURED ARTICLES

In the specifications and on accompanying drawings, there are specified and shown certain pieces of equipment and materials, deemed most suitable for the service anticipated. This is not done, however, to eliminate other equipment and materials equally as good and efficient. When a bidder submits an equivalent, it shall be the responsibility of the bidder to document the equivalence claim. Failure to submit such documentation shall be grounds for the rejection of the claim of equivalence. The bidder shall prepare his bid on the basis of the particular equipment and materials specified or shown, and shall be responsible for the coordination, arrangement and location of all equipment and material incorporated in the work.

1.08 BID SECURITY AND CONSENT OF SURETY

Each bid shall be accompanied by a Certified Check, Cashier's Check or Bid Bond duly executed by the bidder as principal, and having as surety thereon a Surety Company approved by the Owner, in an amount not less than ten percent (10%) of the amount bid but in no case in excess of $20,000.00. Any such Bid Bond shall be without endorsement or conditions. Bid shall also be accompanied with a certificate letter from a surety company stating that it will provide the bidder with the requisite completion performance and payment bonds**,** i.e. a Consent of Surety.

Such bid guarantee will be returned to all bidders, except to the three apparent lowest responsible bidders, within ten days after the formal opening of bids, Sundays and holidays, excepted.

The bid guarantee will be returned to the remaining unsuccessful bidders within three days, Sundays and holidays excepted, after the Owner and the accepted bidder have executed the contract and the Owner has approved the Bidder's Performance Bond, or if no contract has been accepted within 60 days after the date of opening of bids, any bidder upon demand made after the expiration of said 60 day period, shall be entitled to the return of his bid guarantee, so long as he has not been notified by the Owner of the acceptance of his bid.

Any such bid guarantee shall be forfeited and become the property of the Owner if the bidder whose bid is accepted shall fail: to give a satisfactory performance bond and labor and material payment bond, or a combination performance and labor and material payment bond, and/or fails to execute a contract within ten (10) days after notice from the Owner to do so.

Per N.J.S.A. 40A:11-33, a deposit made by any person who makes or causes to be made a false, deceptive or fraudulent statement or answers in response to a questionnaire or in the course of a hearing hereunder may be caused to be forfeited, as liquidated damages by and to the contracting unit.

Furthermore per N.J.S.A. 40A:11-34, any person who makes or causes to be made a false, deceptive or fraudulent statement or answers in response to a questionnaire, or in the course of a hearing hereunder, shall be guilty of a misdemeanor, and upon conviction shall be punishable by a fine of not less than $100.00 nor more than $1,000.00, and shall be permanently disqualified from bidding on all public work or contracts of the contracting unit which submitted the questionnaire; or, in the case of an individual or an officer or employee charged with the duty of responding to the questionnaire for a person, firm, copartnership, association or corporation, by such fine or imprisonment, not exceeding 6 months, or both.

1.09 NEW JERSEY BUSINESS REGISTRATION REQUIREMENTS

Pursuant to N.J.S.A. 52:32-44, Contracting Agency is prohibited from entering into a contract with an entity unless the bidder/proposer/contractor, and each subcontractor that is required by law to be named in a bid/proposal/contract has a valid Business Registration Certificate on file with the Division of Revenue and Enterprise Services within the Department of the Treasury.

Prior to contract award or authorization, the contractor shall provide the Contracting Agency with its proof of business registration and that of any named subcontractor(s).

Subcontractors named in a bid or other proposal shall provide proof of business registration to the bidder, who in turn, shall provide it to the Contracting Agency prior to the time a contract, purchase order, or other contracting document is awarded or authorized.

During the course of contract performance:

(1) the contractor shall not enter into a contract with a subcontractor unless the subcontractor first provides the contractor with a valid proof of business registration.
(2) the contractor shall maintain and submit to the Contracting Agency a list of subcontractors and their addresses that may be updated from time to time.
(3) the contractor and any subcontractor providing goods or performing services under the contract, and each of their affiliates, shall collect and remit to the Director of the Division of Taxation in the Department of the Treasury, the use tax due pursuant to the Sales and Use Tax Act, (N.J.S.A. 54:32B-1 et seq.) on all sales of tangible personal property delivered into the State. Any questions in this regard can be directed to the Division of Taxation at (609)292-6400. Form NJ-REG can be filed online at http://www.state.nj.us/treasury/revenue/busregcert.shtml.

1.10 SMALL BUSINESS CONCERNS OWNED & CONTROLLED BY SED'S

In accordance with the provisions of N.J.S.A. 58:11B-26, N.J.A.C. 7:22-3.17(a)24 and 4.17(a)24, the contractor (subcontractor) shall comply with all of the provisions of N.J.A.C. 7:22-9

The goal of this program is to ensure that businesses owned and operated by socially and economically disadvantaged individual receive a minimum of 10% of the total work funded by State construction grants and loans. Throughout the project, the contractor shall provide the Contracting Agency with its proof of business registration and that of any named SED subcontractor(s).

Before final payment is made under the contract, the contractor shall submit to the Contracting Agency a complete and accurate list of all subcontractors used and their addresses.

Pursuant to N.J.S.A. 54:49-4.1, a business organization that fails to provide a copy of a business registration as required, or that provides false business registration information, shall be liable for a penalty of $25 for each day of violation, not to exceed $50,000, for each proof of business registration not properly provided under a contract with a contracting agency.

2.0 SUBMISSION OF BIDS

2.01 GENERAL

Bidder must submit their bid on the respective "Bid Form and Package" included hereto.

No bid will be accepted or opened if received after the designated time for receipt.

For each bid made, all blank spaces in the Bid Form must be filled in, in ink, with the unit prices of the item and its extension. All bid forms submitted will be checked for arithmetic accuracy. In the event of a discrepancy between the unit price bid for any Pay Item and the extension shown for that item under the column of the Proposal Form designated "Amount," the unit price is to govern. Where a unit price is bid for a Pay Item, but no extension is provided, the Owner will provide the extension based on the unit price bid and the estimated quantity for that Pay Item. Where an extension is provided by the Bidder in the "Amount" column, but no unit price appears in the "Unit Price" column of the Proposal Form, the Owner will provide the unit price by dividing the "Amount" figure provided by the Bidder by the estimated quantity.

Award will be made on the basis of Total Contract Price. The Total Contract Price means the correctly determined summation of lump sum bids and products of all quantities for Pay Items shown in the Proposal form multiplied by the unit prices bid.

If there are minimum unit prices included in the bid form, those prices shall be the minimum acceptable unit price for the work. If bidder fails to exceed the minimum unit price in his bid, the unit price will be set to the minimum price stated on the bid form, with the appropriate increase to the extension of the unit price and total bid price.

Where no figure is provided by the Bidder in both the "Unit Price" and "Amount" columns for one or more Pay Items, or where no figure is provided in the "Amount" column for one or more lump sum Pay Items the Owner will consider the amount bid to be zero ($0.00) for that item.

Any bid may be submitted or withdrawn prior to the scheduled time for the opening of bids, or authorized postponement thereof. Any bid received after the time and date specified in the Notice to Bidders will not be considered. No bid may be withdrawn within 60 days after the actual date of opening thereof, unless otherwise provided for by law.

2.02 PRICE TO INCLUDE

The bid submitted must cover the entire cost of the contemplated construction and installation as illustrated on the drawings and in the manner and detail described in the specifications. The price bid for each item shall cover the entire cost of its installation, construction, and completion, including all materials, workmanship, and appurtenances necessary for its completion or as implied by illustration on the drawings, by description in the specifications, or to be reasonably inferred therefrom.

The contractor shall pay not less than the prevailing wage rate to workers employed in the performance of any contract for the project, in accordance with the rate determined by the Commissioner of New Jersey Department of Labor pursuant to N.J.S.A. 34:11-56.25 et seq. OR the United States Secretary of Labor pursuant to 29 CFR Part 5, whichever is greater.

2.03 REJECTION OF BIDS

The owner reserves the right to reject all bids, to reject any bid or bids not complying with the specifications, and to waive any informality in any bid or bids if such waiver be deemed by the Owner to be in the best interests of the Owner in accordance with the requirements contained in N.J.S.A. 40A:11-1 et seq. in accordance with N.J.S.A 40A:11-13.2 A contracting unit may reject all bids for any of the following reasons:

a. The lowest bid substantially exceeds the cost estimates for the goods or services.
b. The lowest bid substantially exceeds the contracting unit's appropriation for the good or services.
c. The governing body of the contracting unit decides to abandon the project for provision or performance of the goods or services.
d. The contracting unit wants to substantially revise the specifications for the goods or services.
e. The purposes or provisions or both of P.L.1971, c.198 (C.40A:11-1 et seq.) are being violated.
f. The governing body of the contracting unit decides to use the State authorized contract pursuant to section 12 of P.L.1971, c.198 (C.40A:11-12).

Each bidder is instructed to be present in person or by representative at the time and place fixed for the opening of bids and at every subsequent meeting of the Owner at which the bidder is advised, or it has been publicly announced at the time of bids, that said bids shall receive further consideration or shall be acted upon, if said bidder desires an opportunity to be heard.

2.04 AWARD OF BID

The award of the contract will be made, subject to necessary monies to do the work being provided by the Owner in accordance with the requirements contained in N.J.A.C. 5:30, Local Finance Board, either by Resolution, Ordinance, or in other lawful manner. The contract to be executed by the successful bidder will provide that it shall not become effective until the necessary monies to do the work have been provided by the Owner, either by Resolution, Ordinance or another lawful manner.

Pursuant to N.J.S.A. 40A:11-16(c); Contracts shall be awarded to the lowest responsible bidder. In the event that a contract is advertised for both separate bids for each branch of work and for bids for all work, goods, and services, said contract shall be awarded in the following manner: If the sum total of the amounts bid by the lowest responsible bidder for each branch is less than the amount bid by the lowest responsible bidder for all the work, goods and services, the contracting unit shall award separate contracts for each of such branches to the lowest responsible bidder therefor, but if the sum total of the amounts bid by the lowest responsible bidder for each branch is not less than the amount bid by the lowest responsible bidder for all the work, goods and services, the contracting unit shall award a single overall contract to the lowest responsible bidder for all of such work, goods and services. In every case in which a contract is awarded for a single overall contract, all payments required to be made under such contract for work, goods and services supplied by a subcontractor shall, upon the certification of the contractor of the amount due to the subcontractor, be paid directly to the subcontractor.

The award of the contract shall be made in accordance with N.J.S.A. 40A:11-6.1 &24, which states the Owner shall award the contract or reject all bids within such time as may be specified in the invitation to bid, but in no case more than 60 days, except that the bids of any bidders who consent thereto may, at the request of the Owner, be held for consideration for such longer period as may be agreed. All bid security, except the security of the three apparent lowest responsible bidders, shall be returned, unless otherwise requested by the bidder, within 10 days after the opening of the bids, Sundays and holidays excepted, and the bids of such bidders shall be considered as withdrawn. Within three days, Sundays and holidays excepted, after the awarding and signing of the contract and the approval of the contractor's performance bond, the bid security of the remaining unsuccessful bidders shall be returned to them.

The contract shall be signed by all parties within the time limit set forth in the specifications, which shall not exceed 21 days, Sundays and holidays excepted, after the making of the award; provided, however, that all parties to the contract may agree to extend the limit set forth in the specifications beyond the 21-day limit required in this subsection. The contractor, upon written request to the contracting unit, is entitled to receive, within seven days of the request, an authorization to proceed pursuant to the terms of the contract on the date set forth in the contract for work to commence, or, if no date is set forth in the contract, upon receipt of authorization. If for any reason the contract is not awarded and the bidders have paid for or paid a deposit for the plans and specifications to the contracting unit, the payment or deposit shall immediately be returned to the bidders when the plans and specifications are returned in reasonable condition within 90 days of notice that the contract has not been awarded.

In accordance with NJSA 34:11-56.25 et seq., New Jersey State Prevailing Wage Act, no contract shall be awarded to any contractor, subcontractor, or to any firm, corporation or partnership in which such contractor or subcontractor has an interest, who is debarred from public works.

3.0 CONTRACTS

3.01 DRAWINGS AND SPECIFICATIONS FURNISHED

The Engineer shall furnish, at no additional cost to the successful bidder, one executed contract set of drawings and specifications, and two copies of the specifications and drawings. All additional copies of the drawing and/or specifications shall be furnished to the contractor at the cost of reproduction plus handling.

3.02 PERFORMANCE, PAYMENT AND MAINTENANCE BONDS

The bidder whose bid is accepted shall furnish to the Owner, a performance bond and labor and material payment bond, or a combination performance and labor and material payment bond, and upon final completion of the work, a two (2) year maintenance bond, each in the amount of 100% of the final contract price, with such sureties as shall be approved by the Owner and as detailed and described below.

The project sponsor shall require that the Contractor ALSO supply an environmental maintenance bond in the amount of $25,000 or 50 percent of the price bid for the materials needed to fulfill the environmental specifications, whichever is greater. The environmental maintenance bond shall provide that the Contractor shall remedy, without cost, any defects which result from faulty workmanship, or from failure to comply with the specifications and which develop during the period of one year from the expiration of the performance bond, required pursuant to N.J.S.A. 40A:11-22.

All surety companies must be authorized to transact such business in New Jersey, pursuant to N.J.S.A. 17:17-10 or 17:32-1 et seq. The surety must designate a New Jersey agent on whom service of process can be made. The Contractor shall be responsible for updating the surety's expiration from the list or an agent change, to the Engineer or Owner. All surety companies must have the minimum capital and surplus or net cash assets required, pursuant to N.J.S.A. 17:17-6 or 17:17-7, whichever is applicable, on the date of advertisement for the project. All surety companies must complete a Surety Disclosure Statement and Certification for all payment and performance bonds, pursuant to N.J.S.A. 2A:44-143d.

In addition, for these public works project bids, including any and all alternates, that equals at least $850,000.00 but not more than $3.5 million, the surety company must hold a current certificate of authority issued by the U.S. Secretary of the Treasury that is valid in New Jersey as listed annually in the U. S. Treasury Circular 570. However, if the surety company has been operational for a period in excess of five years, the surety company shall also be considered to have satisfied this requirement if it is rated in one of the three highest categories by an independent nationally recognized United States rating company

that determines the financial stability of insurance companies. Such rating companies must meet standards promulgated by the N. J. Commissioner of Insurance N.J.A.C. 11:1-41.1 et seq.

In addition, for those public works project bids, including any and all alternates, is in excess of $3.5 million, the surety company must hold a current certificate of authority issued by the United States Secretary of the Treasury that is valid in the State of New Jersey listed annually in U.S. Treasury Circular 570. And, if the surety company has been operational for a period in excess of five years, it must be rated in one of the three highest categories by an independent, nationally recognized United States rating company that determines the financial stability of insurance companies. Such ratings must meet standards promulgated in N.J.A.C. 11:1-41.1 et seq.

A surety company, which seeks to provide a payment and performance bond in excess of $3.5 million, is exempt from the requirement of Treasury Circular 570 if it meets standards developed by the Commissioner of Insurance through regulations which, at least equal, and may exceed, the general criteria required for Treasury listing. These standards are found at N.J.A.C. 11:1-41.4.

3.03 LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable Federal, State, County and municipal laws ordinances, regulations, etc. and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though therein written out in full including, but not limited to the "Occupational Safety and Health Act of 1970" P.L. 91-596, as amended.

3.04 PERMITS

The Contractor shall determine which construction permits and licenses shall be needed, and shall procure and pay for all such construction permits and licenses necessary for the execution of his work.

3.05 CONTRACT DOCUMENTS

Attached hereto is the "Form of Contract" that will be executed between the Owner and the Contractor.

The Contractor shall execute and return these documents with the required bonds, insurance certificates, affirmative action forms and any other documents required within ten (10) days after receipt of the request for execution.

3.06 NOTICE TO PROCEED

After approval and execution of the contract documents by all parties and a preconstruction meeting, the contractor shall be sent a "Notice to Proceed." This document serves as formal authorization to proceed with the project.

Any and all work performed by the contractor prior to receipt of the Notice to Proceed is at the contractor's risk with no claim against the Owner for such work.

4.0 AFFIRMATIVE ACTION AGAINST DISCRIMINATION

4.01 BIDDER REFERRED TO LAW

The bidder is specifically referred to N.J.S.A. 10:5-31 et seq., and N.J.A.C. 17:27 as amended and the Regulations adopted pursuant thereto, relating to affirmative action in relation to discrimination.

4.02 SPECIFIC LANGUAGE REQUIRED

In accordance with the Affirmative Action Regulations adopted pursuant to N.J.S.A. 10:5-31 et seq., and N.J.A.C. 17:27, the following is made a part of this Contract:

a. Exhibit B of the model Instructions to Bidders and Statutory Requirements is the current and complete mandatory language for construction bid specifications and contracts.
The document is the mandatory language for construction bid specifications and contracts pursuant to N.J.A.C. 17:27-3.5, and the mandatory bid specification and contract language for employment goal compliance for construction contracts at N.J.A.C. 17:27-3.7. A complete review of both rule provisions is recommended.

During the performance of this contract, the contractor agrees as follows:

a. The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, up‐ grading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

b. The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

c. The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

e. When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. l7:27‑ 7.2; provided, however, that the Dept. of LWD, Construction EEO Monitoring Program may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B and C, as long as the Dept. of LWD, Construction EEO Monitoring Program is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Dept. of LWD, Construction EEO Monitoring Program, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. l7:27‑ 7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

(l) To notify the public agency compliance officer, the Dept. of LWD, Construction EEO Monitoring Program, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers.

(2) To notify any minority and women workers who have been listed with it as awaiting available vacancies.

(3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;

(4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contactor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Dept. of LWD, Construction EEO Monitoring Program. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Dept. of LWD, Construction EEO Monitoring Program, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Dept. of LWD, Construction EEO Monitoring Program.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Dept. of LWD, Construction EEO Monitoring Program and submitted promptly to the Dept. of LWD, Construction EEO Monitoring Program upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where

required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an initial project workforce report (Form AA 201) electronically provided to the public agency by the Dept. of LWD, Construction EEO Monitoring Program, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Division and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on‐the‐job and/or off‐the‐job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or other documents to the Dept. of LWD, Construction EEO Monitoring Program as may be requested by the Dept. of LWD, Construction EEO Monitoring Program from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Dept. of LWD, Construction EEO Monitoring Program for conducting a compliance investigation pursuant to N.J.A.C. 17:27-1.1 et seq.

f. Appendix A of the model Instructions to Bidders and Statutory Requirements is the current and complete mandatory language for construction bid specifications and contracts.

The document is the mandatory language for construction bid specifications and contracts pursuant to N.J.A.C. 17:27-3.5, and the mandatory bid specification and contract language for employment goal compliance for construction contracts at N.J.A.C. 17:27-3.7. A complete review of both rule provisions is recommended.

4.03 CONTRACT PROCEDURES

The Contractor must sign a contract containing the mandatory language in Section 4.02 above entitled "Specific Language Required."

The construction contractors shall complete and submit an Initial Project Workforce Report Form AA-201 upon notification of award. Proper completion and submission of this Report shall constitute evidence of the contractor’s compliance with the regulations. Failure to submit this form may result in the

contract being terminated. The contractor also agrees to submit a copy of the Monthly Project Workforce Report, Form AA-202 once a month thereafter for the duration of the contract to the Dept. of LWD and to the Public Agency Compliance Officer.

The EEO/AA evidence must be submitted after notification of award, but prior to signing a construction contract. All Public Agencies must retain the affirmative action evidence in their files for review by the Division.

4.04 EQUAL OPPORTUNITY FOR INDIVIDUALS WITH DISABILITIES

The contractor and the Owner do hereby agree that the provisions of Title II of the Americans With Disabilities Act of 1990 (the "Act") (42 U.S.C. S12101 et seq.), which prohibits discrimination on the basis of disability by public entities, in all services, programs and activities provided or made available by public entities, and the rules and regulations promulgated pursuant thereunto, are made part of this contract. In providing any aid, benefit or service on behalf of the Owner pursuant to this contract, the contractor agrees that the performance shall be in strict compliance with the Act. In the event the contractor, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this contract, the contractor shall defend the Owner in any action or administrative proceeding commenced pursuant to this Act. The contractor shall indemnify, protect, and save harmless the Owner, its agents, servants and employees from and against any and all suits, claims, losses, demands, or damages of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The contractor shall, at its own expense, appear, defend, and pay any and all charges for legal services and any and all costs or other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the Owner's grievance procedure, the contractor agrees to abide by any decision of the Owner which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the Owner, or if the Owner incurs any expense to cure a violation of the Act which has been brought pursuant to its grievance procedure, the contractor shall satisfy and discharge the same at its own expense.

The Owner shall, as soon as practical after a claim has been made against it, give written notice thereof to the contractor along with the full particulars of the claim. If any action or administrative proceeding is brought against the Owner or any of its agents, servants and employees, the Owner shall expeditiously forward or have forwarded to the contractor every demand, complaint, notice, summons, pleading, or other process received by the Owner or its representatives.

It is expressly agreed and understood that any approval by the Owner of the services provided by the contractor pursuant to this contract will not relieve the contractor of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the Owner pursuant to this paragraph.

It is further agreed and understood that the Owner assumes no obligation to indemnify or save harmless the contractor, its agents, servants, employees and subcontractors for any claim which may arise out of their performance of this contract. Furthermore, the contractor expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the contractor's obligations assumed in this contract, nor shall they be construed to relieve the contractor from any liability, nor preclude the Owner from taking any other actions available to it under any other provisions of this contract or otherwise at law.

CONTRACT FOR *(INSERT PROJECT NAME)*

THIS AGREEMENT, between the, *(insert owner name)* a (municipal corporation, municipal utilities authority, regional sewerage authority, etc.) of the State of New Jersey, having its principal offices located at *(insert owner address)*, hereinafter referred to as Owner and *(insert contractor name)* , having its principal place of business located at *(insert contractor address)* hereinafter referred to as "Contractor;"

WITNESSETH;

That for and in consideration of the sum of and 00/100 ($000,000.00), contractor agrees to furnish to the Owner, the labor, material, equipment and services in accordance with the contract documents hereinafter set forth.

That for and in consideration of the amount payable under this agreement by the Owner, the Contractor agrees, at its own proper cost and expense, and with due skill and diligence, that it will complete the *(insert project name)* project in accordance with the contract documents and in compliance with this agreement.

Contractor agrees to receive as full compensation the amount stated herein, namely $000,000.00, for said services provided to the Owner. Contractor shall be responsible for all loss or damage arising out of the furnishing of the services aforesaid.

To prevent all disputes and litigation, it is agreed by and between the parties to the Contract that the Owner shall in all cases determine the quantity of the goods delivered and paid for under this contract, and as to the interpretation of any ambiguity in or intent of the drawings and specifications.

The Contract documents shall consist of the following:

1. Notice to Bidders.
2. Specifications.
3. Contractors Proposal (as accepted).
4. Contract Agreement.
5. Contract Drawings
6. All Addenda.

The parties to this contract agree to incorporate into this contract the mandatory language of the Regulations promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27, as amended and supplemented from time to time and the contractor or subcontractor agrees to comply fully with the terms, provisions, and obligations of said Regulations.

AND in all respects comply with all requirements of the Labor Laws of the State of New Jersey, applicable to contracts on behalf of the Municipal Government for construction, alteration, or repair of any building or public work, including particularly, be without limitation of the foregoing, the provision that not less than the prevailing rate of daily wages in the locality where the work is performed shall be paid to mechanics, workmen and laborers employed by the contractors or subcontractors or by or in behalf of the State or any county or municipality;

(*The contract partner*) shall maintain all documentation related to products, transactions or services under this contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

Payment shall be made to said Contractor by orders upon the Treasurer of said *(insert appropriate entity, i.e. Borough, City, Township…)*, founded upon estimates of the *(insert appropriate entity, i.e. Borough Council, City Council, Township Committee…)* as to the amount of work done or articles furnished and delivered, or both, and upon presentation by said Contractor, to the *(insert appropriate entity, i.e. Borough, City, Township…)* Treasurer of said *(insert appropriate entity, i.e. Borough, City, Township…)* an appropriate voucher setting forth, in writing, the amount of work done or goods furnished, and that the work done or articles furnished are according to this Contract, and according to law;

AND it is distinctly and mutually understood and agreed by and between the parties hereto, that in case a default is made in the completion of the Contract, in accordance with the terms and conditions

hereof, such money as may be due to said Contractor, or such as would have become due had the terms and conditions of this Contract and agreement been complied with, shall be and is hereby forfeited to said *(insert appropriate entity, i.e. Borough, City, Township…)*, and said *(insert appropriate entity, i.e. Borough, City, Township…)* is free to use the same in and about the completion of said contract, and in case said *(insert appropriate entity, i.e. Borough, City, Township…)* is put to any costs and expenses over and above the contract price of the Contractor, in and about the completion of the Contract, said Contractor for themselves, itself, their heirs, executors, administrators, successors and assigns, expressly agree to hold themselves, itself, their heirs, executors, administrators, successors and assigns, liable therefore, and hereby covenant and agree to make good the same to the *(insert appropriate entity, i.e. Borough, City, Township…)*. Upon *(insert appropriate entity, i.e. Borough, City, Township…)*determination that services provided by the contractor are unsatisfactory, said contract may be cancelled subject to thirty (30) days written notice being provided to the contractor;

The Contractor agrees to make payments of all proper charges for labor and materials required in the aforementioned work, and defend, indemnify and save harmless the *(insert owner name)*, its officers, agents and servants and each and every one of them against and from all suits and costs of every name and description, including attorney's fees and costs and from all damages to which said *(insert owner name)* or any of its officers, agents or servants may be put by reason of injury to the person or property of others resulting from carelessness in the performance of said work, or through the negligence of the Contractor, or through any improper or defective machinery, implements or appliances used by said Contractor in the aforesaid work or through any act or omission on the part of said Contractor, or his agent or agents. This provision applies regardless of whether insurance coverage is provided. It is also agreed and understood that the acceptance of the final payment by the Contractor shall be considered as a release in full of all claims against the *(insert appropriate entity, i.e. Borough, City, Township…)* out of, or by reason of, the work done and materials furnished under this contract; and

AND it is expressly understood and agreed that this Contract and the referenced inclusion of the bid documents represent the full understanding between the parties and any representations, whether oral or in writing, not contained herein, will not be binding on the parties hereto.

This agreement, together with the contract documents, forms the contract and they are as fully a part of this contract as if hereto attached or herein repeated.

The Owner and the Contractor, for themselves, their heirs, executors, administrators, successors or assigns, hereby agree to the full performance of the covenants herein contained.

IN WITNESS WHEREOF, they have executed this Agreement.

CONTRACTOR: ATTEST:

_____ BY_____

_____ _____

Print Name & Title **Print Name & Title (Seal)**

Dated this ____ day of _____, 20__.

OWNER: ATTEST:

_____ BY_____

(Seal)

Dated this ____ day of _____, 20__.

CERTIFICATE OF INSURANCE

Name & Address of Insured

					Limits of Liability		
Afforded	Required (Enter (X))	Type of Insurance	Policy Number and Insuring Company(ies)	Policy Expiration Date	Amounts of Less Than $1,000,000 Will Not Be Acceptable	Amount Required Each Occurrence	Amount Provided Each Occurrence
☐	☒	General Liability Comprehensive Gen. Form			General Aggregate	$2,000,000	$
☐	☒	Premises-Operations			Bodily Injury	$1,000,000	$
☐	☒	Explosion & Collapse Hazard					
☐	☒	Underground Hazard			Property Damage	$1,000,000	
☐	☒	Products/Completed Operations Hazard					
☐	☒	Contractual Ins. (Blanket)			Bodily Injury and Property Damage Combined	$1,000,000	$
☐	☒	Broad Form Prop. Damage					
☐	☒	Independent Contractors					
☐	☒	Personal Injury			Personal Injury	$	$
		Automobile Liability			Bodily Injury (Each Person)	$	$
☐	☒	Comprehensive Form			Bodily Injury (Each Accident)	$	$
☐	☒	Owned				$	$
☐	☒	Non-Owned			Property Damage	$	$
☐	☐	Garagekeepers Insurance (Without regard to legal liability as direct coverage on a primary basis)			Bodily Injury and Property Damage Combined	$1,000,000	
		Excess Liability			Bodily Injury and	$1,000,000	$
☐	☒	Umbrella Form			Property Damage Combined		
☐	☐	Other Than Umbrella Form					
☐	☒	Worker's Compensation and Employers' Liability	*All States Endorsement		Statutory NJ Coverage $100,000/$500,000 Minimum $100,000	$100,000	$

Remarks: Additional Insured: **REMINGTON & VERNICK ENGINEERS, MERCHANTVILLE PENNSAUKEN WATER COMMISSION (MPWC), MPWC'S SPLICITOR, NJDEP AND THEIR AGENTS**

It is understood and agreed that in the event of any material change in, cancellation of, or expiration of the above policy or policies the undersigned Insurance Company agrees to given a written notice to the Owner, at the above address thirty (30) days in advance of such change or cancellation.

This certificate is executed and issued to the Owner on the day and date herein below written certifying that the Insured has been issued the above policy or policies with Limits of Liability of at least the required amounts.

*** PLEASE PUT "X'S" IN AFFORDED COLUMN OR CERTIFICATE WILL BE RETURNED ***

Name of Agency

Street Address

City, State & Zip Code

Signature of Authorized Representative of Insurance Company

Address Date

Agency Telephone No.

TO: INSURANCE PRODUCER

Your client, as a supplier to the Owner is required to provide a certificate of insurance for the coverages and amounts indicated on the reverse side of this insurance certificate. It is important to your client that you respond quickly since continued business relationships depend upon valid insurance. Additionally, the minimum amount and type of coverage shown on our certificate is not negotiable and is not intended to imply that is all the insurance necessary to protect him/her from all losses or liability. It is the Owner's policy to require all suppliers who make deliveries or perform assembly, repair operations or a service in, on or upon our property/premises or property/premises under our care, custody and control to maintain the insurance coverage described below; such insurance must be obtained prior to the start of any such work the Owner.

A. Comprehensive General Liability (CGL)

This coverage must include: Premises-Operations, Products/Completed Operations Hazard, Contractual Insurance (Blanket Coverage), Broad Form Property Damage, Independent Contractors, and Personal Injury and all others shown on "X" in the required column.

Minimum Coverage

Bodily Injury and Property Damage combined - as shown in the amount required column

AMOUNTS OF LESS THAN $1,000,000 WILL NOT BE ACCEPTABLE.

Contractual Insurance (Blanket Coverage)

Contractual Indemnification - Save Harmless Agreement which is incorporated into all Vouchers, General Purchase Agreements and Contracts.)

INDEMNIFICATION

Supplier shall defend, indemnify and save harmless, the Owner from and against all losses, costs, damages, expense claims or demands arising out of or caused or alleged to have been caused in any manner by a defect in any equipment or materials supplied hereunder or by doing the work herein provided, including all suits or actions of every kind of description brought against Owner, either individually or jointly with Supplier for or on account of any damage or injury to any person or persons or property, caused or occasioned or alleged to have been caused by or on account of the performance of any work pursuant to or in connection with this contract or through any negligence or alleged negligence in guarding the work or through any act, omission or fault or alleged act, omission or fault of the Supplier, its employees or agents, or others under Supplier's control.

B. Automobile Liability - Comprehensive Form (or as shown on reverse side)

Minimum Coverage

Bodily Injury and Property Damage combined - as shown in the amount required column.

C. Worker's Compensation - As required by New Jersey State Statute

and

Employer's Liability (minimum $100,000)

D. Excess Liability

Commercial Umbrella Form - $1,000,000.

E. Other Coverage(s)

As shown on reverse side.

THANK YOU

Important - Producer:

PLEASE CHECK THE AFFORDED BLOCK FOR EACH COVERAGE PROVIDED.

THE CERTIFICATE MUST BE SIGNED BY THE AGENT OF THE INSURER OR CERTIFICATE WILL BE RETURNED.

IT IS NECESSARY TO SUBMIT YOUR CLIENTS COVERAGE THIRTY (30) DAYS PRIOR TO THE EXPIRATION OF THE EXISTING COVERAGE ON OUR CERTIFICATE ONLY; ALL OTHERS WILL BE RETURNED TO THE SUPPLIER AND SERVE TO DELAY FUTURE BUSINESS DEALINGS BETWEEN THE OWNER AND YOUR CLIENT.

7.0 SUPPLEMENTAL CONDITIONS
INFORMATION FOR BIDDERS

Under **Section 1.08 Bid Security and Consent of Surety,** add the following**:**

All applicable surety bonds required in connection with the advertisement and award of building contracts or subagreements must be written by a surety company listed on the Federal Treasury List (Department Circular 570 - Surety Companies Listed on Federal Bonds).

Under **Section 1.0 Bid Preparation,** add the following subsection**:**

1.10 SMALL BUSINESS CONCERNS OWNED & CONTROLLED BY SEDs

The Owner is required to comply with N.J.A.C. 7:22-3.17(a)24 and 7:22-4.17(a), or 7:22-6.17(a)24, which require that no less than 10 percent of the total amount of all contracts related to the project shall be awarded to SEDs.

1.11 DEBARMENT

In accordance with N.J.A.C. 7:22-3.39, the Contractor may be debarred, suspended or disqualified from contracting on any project financially assisted by the State or the Department if the contractor commits any of the acts listed in N.J.A.C. 7:1D-2.

Any person included on the State Treasurer's list as a result of action by a State agency, who is or may become a bidder on any contract which is or will be funded by a Fund loan, may present information to the Department why this section shall not apply to such person. If the Department determines that it is essential to the public interest and files a finding thereof with the New Jersey Attorney General, the Department may grant an exception from the application of this section with respect to a particular contract, in keeping with N.J.A.C. 7:1D-2.9. In the alternative, the Department may suspend or debar any such person, or take such action as may appropriate, pursuant to N.J.A.C. 7:1D-2.

Under **Section 3.04 Permits,** add the following**:**

In accordance with N.J.A.C. 7:14-2.3 “Permits”:

“Federal, State, county and municipal permits required as a result of the construction activity within the delineated site shall be obtained by the Owner and associated fees shall be paid by the Owner. In addition, permits required for construction activities on railroad properties shall be obtained by the Owner.

Exceptions to this section shall be a permit to use explosives for rock excavation and such other permits which by law are required.

The Owner shall make every reasonable effort to identify permits and fees and costs required as a result of the construction activity in effect 60 days prior to the receipt of construction bids. This responsibility may be delegated to the Owner’s Engineer with adequate compensation for this service. The Engineer shall be help harmless from any penalty or action resulting from the failure to obtain a permit where every reasonable effort has been made by the Engineer to obtain such permits. Conditions made a part of any permit shall be imposed upon the Contractor as described in the contract or bid documents. Additional costs

associated with a permit resulting from the construction activity which is beyond the stipulated in the contract shall be the responsibility of the Contractor.

Wherever necessary or appropriate the Contractor shall assist the Owner in the acquisition of permits.

The Department may intercede and assist in the resolution of any problems resulting from the acquisition of any permits."

APPENDIX A

SAMPLE BOND FORMS

- Bid Bond
- Performance Bond
- Payment Bond
- Environmental Maintenance Bond
- General Maintenance Bond

BID BOND FORM
(NEW JERSEY FORM)

KNOW ALL PERSONS BY THESE PRESENTS: That we, "the Bidder," _____ _____ a corporation__, individual ___, partnership__, joint venture___ , of the State of_____, qualified to do business in the State of New Jersey, as Principal, and "the Surety," _____ , of the State of_____ licensed to do business as surety in the State of New Jersey, are hereby held and firmly bound unto the_____ _____- "the **Owner**," as Obligee, in the amount of either ten percent (10%) of the Base Bid, plus all alternatives, but not in excess of $20,000, which equates to _____ Dollars ($), for the payment of which the Bidder and the Surety hereby bind ourselves, our respective heirs, successors, legal representatives and assigns, jointly and severally, firmly by these presents in accordance with New Jersey Law.

WHEREAS, the Bidder has submitted to the Owner a Bid, to which this Bond is attached, to enter into the Contract with the **Owner** for _____ covered by Bidding Documents prepared by the **Engineer**, which Bidding Documents are incorporated into this Bid Bond by this reference:

NOW, THEREFORE: THE CONDITION OF THIS OBLIGATION IS THAT, if the Bidder (a) faithfully performs and fulfills all the understandings, covenants, terms, conditions and requirements of the Bidding Documents (including written Addenda issued before Bid opening) within the time specified or any extension thereof, with or without notice to the Surety, or (b) fails to comply-with all the understandings, covenants, terms, conditions and requirements of the Bidding Documents (including written Addenda issued before Bid opening) within the time specified or any-extension thereof, with or without notice to the Surety, but pays the **Owner** the difference, not to exceed the sum set forth in this Bond, between the amount given by the Bidder's Base Bid plus those alternates selected by the **Owner** and the amount by which the **Owner** may procure the Work - then THIS OBLIGATION SHALL BE NULL AND VOID, OTHERWISE REMAIN IN FULL FORCE AND EFFECT.

A. As this project is expected -to be funded in part from the New Jersey Environmental Infrastructure Trust, in accordance with N.J.A.C. 7:22-3.17(g) and 7:22-4.17(g), all surety bonds required in connection with the advertisement and award of building contractors or sub-agreements must be written by a surety company listed on the United States Federal Treasury List (Department Circular 570-Surety Companies Acceptable on Federal Bonds) incorporated herein by reference.

B. If the **Owner** makes demand on the Surety to perform in accordance with the Surety's obligations under this Bond, then the full amount of the penal sum shall be immediately due and payable to the **Owner**, and the Surety shall pay that sum without delay and reimburse the **Owner** for all costs of collection.

C. The Surety, for value received, stipulates and agrees that the obligations of the Surety and its Bond shall be in no Way impaired or affected by any extension of the time within which the Owner may accept the Bid, and the Surety does, by this agreement, waive notice of any such extension.

D. The Surety certifies that the Surety will provide for the Bidder a Performance and Payment Bond if the Bidder is awarded the Contract.

E. It is the intention of the Bidder, Surety and Owner that the Surety shall be bound by all terms and conditions of the Bidding Documents and this Bid Bond. However, if any provision(s) of this Bid Bond is/are illegal, invalid or unenforceable, all other provisions of this Bond shall nevertheless remain in full force and effect, and the Owner shall be protected to the full extent provided by New Jersey Law.

IMPORTANT: The Surety shall be licensed to do business in New Jersey.

Address and Telephone of Surety

Address and Telephone of agent

Signed and sealed this _____ day of _____ , 2 0

BIDDER: (Print Full Name)

SURETY: (Print Full Name & Sign)

By: _____

By Agent: _____

Name &
Title: _____

By Attorney-in-Fact: _____
(Attach Certified Copy of Power of Attorney)

_____
WITNESS

_____
WITNESS

PERFORMANCE BOND

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

CONTRACTOR (Name and Address):

SURETY (Name & Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature: _____		Signature: _____	
Name and Title: _____		Name and Title: _____ (Attach Power of Attorney)	

(Space is provided below for signatures of additional parties if required)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corp. Seal)	Company:	(Corp. Seal)
Signature: _____		Signature: _____	
Name and Title: _____		Name and Title: _____ (Attach Power of Attorney)	

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner of other party shall be considered plural where appl
icabl
e.

CONTRACTOR (Name and Address):

SURETY (Name *and* Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than
Contract Date): Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

SURETY
Company: (Corp. Seal)

Signature: _____ _____
Signature:

Name and Title: _____ Name and Title: _____

(Attach Power of Attorney)

(Space is provided below for signatures of additional parties if required)

CONTRACTOR AS PRINCIPAL
Company: (Corp. Seal)

SURETY
Company: (Corp. Seal)

Signature: _____ S Signature:

Name and Title: _____ Name and Title: _____

(Attach Power of Attorney)

ENVIRONMENTAL MAINTENANCE BOND

CONTRACT NO _____

The Contractor shall supply an Environmental Maintenance Bond in the amount of $25,000.00 or 50% of the price bid for the materials needed to fulfill the environmental specifications, whichever is greater. The Environmental Maintenance Bond shall provide remedy without cost of any defects which result from faulty workmanship or failure to comply with the specifications developed during the period of one year from the expiration of the Performance Bond, pursuant to N.J.S.A. 40A:11-22

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

_____

(Name of Contractor)

_____

(Address of Contractor)

_____

(Corporation, Partnership or Individual)

as principal, _____

(Name of Surety)

_____

(Address of Surety)

Hereinafter called Surety, are hereby held and firmly bound unto

_____

(Name of Owner)

_____

(Address of Owner)

Hereinafter called Owner, in the amount of _____

_____ Dollars, ($ _____) in lawful money

of the United States for payment which penal sum of a minimum of twenty-five thousand dollars ($25,000.00 minimum) or fifty (50) percent of price bid for the payment of which well and truly be made, we hereby jointly and severally bind our self, our heirs, executors, administrators, successors and assigns.

Signed this _____day of _____, 20 ____.

THE CONDITION OP THE ABOVE OBLIGATIONS is such that, whereas, the above named principal did on the _____day of _____, 20 ____.

enter into a Contract with _____ County of _____ , State of _____ , which said Contract is made a part of this bond the same as though set forth herein;

Attest,

_____
(Surety)

_____
(Surety Secretary)
Or Witness as to Surety

_____
(Attorney-in-Fact)

_____
(Typed Name)

_____
(Address)

_____

NOTE: Date of Bond must not be prior to date of Contract execution by Principal (Contractor). If Contractor is a partnership, all partners must execute bond and additional signature, sheets, as necessary, must be attached. A corporate acknowledgment and statement of authority is to be attached by the Surety Company, A surety must also attach the Surety Disclosure Statement and Certification required by P.L. 1995, c.384.

Approval of Bond

The foregoing Bond approved this _____ day of _____, 20 _____

SIGNED BY _____

SIGNATURE _____

TITLE _____

AND whereas the Principal has completed the work required of said contract, and whereas the obligee requires a maintenance guarantee for the period of one year from the expiration of the performance bond for the work required to fulfill the environmental and cultural resource protection and restoration requirements of the specifications; and whereas if the Principal at his own cost and expense replaces or repairs any of the above described works, which, shall become defective because of either material or workmanship not meeting requirements of the specifications under which the work was done during the period of one year from the data of the expiration of the performance bond, then this obligation shall be null and void, otherwise to remain in full force and effect.

The said surety hereby stipulates and agrees that no modifications, omissions or additions in or to the terms of the said contract or in or to the plans or specifications therefor shall in anywise affect the obligation of said surety on its bond.

Recovery of any claimant under the bond shall be subject to the conditions and provisions of N.J.S.A.2A:44-143 et Seq., to the same extent as if such conditions and provisions were fully incorporated in the form set forth herein.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed an original, this _____ day of_____, 20 ___

ATTEST:

_____
Principal (Contractor)

_____ BY: _____

(Principal) Secretary
or Witness as to Principal

_____(_____
(Typed Name)

_____
(Address)

_____

GENERAL MAINTENANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____ hereinafter called "Principal," and _____ a corporation of the State of _____, hereinafter called "Surety", are held and firmly bound unto the _____, hereinafter called "Obligee", in the penal sum of _____DOLLARS and _____ CENTS ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain Contract with the Obligee, dated the _____ day of _____, 20____, (hereinafter called the Contract) for the construction of

_____

which said Contract and Specifications for said work shall be deemed a part of this Bond the same as set forth herein.

WHEREAS, the Obligee has required this Bond guaranteeing the repair and replacement necessitated by defects in materials, workmanship or failure to comply with any conditions of said Contract.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said Contract during the guarantee period thereof, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such Contract, and shall fully indemnify and save harmless the Obligee and the State of New Jersey from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Obligee may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that the said Surety for value received hereby stipulates and agrees that no change, extension, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension, alteration or addition, and further;

PROVIDED, that no final settlement between the Obligee and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each one of which shall be deemed an original, this the ____ day of _____, 20___.

ATTEST:

_____ SECRETARY _____

PRINCIPAL

_____

BY

(SEAL)

_____

ADDRESS

_____

WITNESS AS TO PRINCIPAL

_____

ADDRESS

ATTEST:

_____ SECRETARY _____

SURETY

_____

BY ATTORNEY-IN-FACT**

(SEAL)

_____ _____

WITNESS AS TO SURETY ADDRESS

** *THE SURETY COMPANY ATTORNEY-IN-FACT SHALL ALSO SUBMIT A DULY NOTARIZED POWER-OF-ATTORNEY.*

TABLE OF CONTENTS
GENERAL CONDITIONS

Note: Requirements under this subchapter take precedent over any contradictory language with these specifications.

I. Prompt Payment Certification

J. BABA

GENERAL CONDITIONS

1.0 GENERAL

1.01 DEFINITIONS

The following words and expressions used in the contract documents shall be construed as follows:

Owner.....Merchantville Pennsauken Water Commission
6751 Westfield Avenue
Pennsauken, New Jersey 08110

Engineer . .....Remington & Vernick Engineers
2059 Springdale Road
Cherry Hill, New Jersey 08003

Contractor.....Party, firm, corporation with whom or which the contract is made, or authorized agent thereof.

Day .....Calendar day.

Legal Holiday.....Days which the owner does not conduct regular business hours. The Contractor is responsible to contact the Owner for a listing of these days.

Substantial Completion ……. The work will not reach Substantial Completion until all project systems included in the work are operational as designed and scheduled, all designated or required inspections, certifications, permits, approvals, licenses and other documents from any governmental authority having jurisdiction thereof necessary for the beneficial use and occupancy of the work are received, designated instruction of Owner's personnel has been completed, and all final finishes within the Contract are in place. Any remaining work shall be minor in nature, so that the Owner can occupy the building on that date and the completion of the remaining work by the Contractor would not materially interfere or hamper the Owner's (or those claiming by, through or under the Owner) normal operations. Contractor recognizes that normal operations require the use and occupancy of the work area without interruption and that any punchlist or corrective work shall be done at times when the work area is not so occupied. As a further condition of reaching Substantial Completion, the Contractor shall certify that all remaining work will be completed within thirty (30) consecutive calendar days or as so agreed upon following the date of Substantial Completion. Site related projects and/or projects including facilities with site improvements shall not reach Substantial Completion until such time as all site amenities (i.e. lighting, top paving, striping, fencing, stormwater compliance, etc..) are placed into service leaving only minor improvements that will not hamper access or use to complete the project."

Final Completion ……...All warranties and guarantees required pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Owner as part of the final application for payment. The final Certificate for Payment will not be issued by the Engineer until all warranties and guarantees have been received and accepted by the Owner.

1.02 SPECIAL NOTICE

The "Information for Bidders", the "General Conditions", the "Notice to Bidders", and "Proposal Section" shall be held equally binding with and are to be considered a part of the specifications and contract and the party of the second part, the Contractor, will be held responsible for neglect in attending to any part, paragraph or item therein.

1.03 REPRESENTATION OF CONTRACTOR

The Contractor represents and warrants:

(a) That he is financially solvent and that he is experienced in and competent to perform the type of work to furnish the labor, plant, materials and supplies or equipment to be so performed or furnished by him and

(b) That he is familiar with all Federal, State, County, Municipal and Department Laws, Ordinances and Regulations, which may in any way affect the work or those employed therein, including, but not limited to, any special Acts relating to the work or to the project of which it is a part, and

(c) That such temporary and permanent work required by the contract documents and is to be done by him can be satisfactorily constructed and used for the purpose for which it is intended, and that such construction will not injure any persons or damage any property, and

(d) That he has carefully examined the drawings, specifications, and the site of the work, and that from his own investigations he has satisfied himself as to the nature and location of the work, the character, quality and quantity of surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the work, the general and local conditions and all other items which may in any way affect the work or its performance.

1.04 SUBLETTING OR ASSIGNING OF CONTRACT

The Contractor shall not assign, sell or transfer or otherwise dispose of the contract or any portion thereof or of the work provided therein or his right, title or interest therein, to any persons, firm or corporation, without prior written consent of the Owner.

1.05 CONSTRUING THE SPECIFICATIONS

To avoid disputes and litigation, it must be distinctly understood by the Bidder/Contractor that the Engineer shall construe or interpret the specifications and explain any ambiguity therein and shall have the right to decide as to their purpose and intent and his decision upon any such ambiguity shall be final, conclusive and binding.

1.06 NECESSARY TO COMPLETE

If any work or materials are required which are obviously necessary to carry out the full intent and meaning of the said specifications although the same may not be either directly or indirectly in the specifications, the Contractor is hereby bound to furnish the same without charge or claim.

1.07 DRAWINGS AND SPECIFICATIONS

The Contractor shall keep at the site of the work one copy of the drawings and specifications signed and identified by the Engineer and shall at all times give the Engineer and other representatives of the Owner access thereto. Anything shown on the drawings and not mentioned in the specifications, or mentioned in the specifications and not shown on the drawings, shall have the same affect as if shown or mentioned respectively in both. In case of any conflict within the construction documents, the Engineer shall determine which of the requirements shall govern based upon the most stringent of the requirements, and the Contractor shall perform

the work at no additional cost or time to the owner. Any ambiguity or discrepancy between drawings and specifications shall be submitted by the Contractor to the Engineer whose decision shall be conclusive.

The general arrangement and location of equipment, the various pipe, duct, and conduit runs, etc. are shown on the drawings. All dimensions or the scales of the drawings shall be considered as approximate and shall be checked by each bidder to his own satisfaction prior to bid. The exact location of all parts of the work shall be governed by existing conditions, and the Contractor shall coordinate and locate all work at the time of installation. Any changes in location, etc. from that shown on the drawings, necessary by existing conditions, shall be made by the Contractor at no increase of the contract sum.

1.08 RIGHT-OF-WAY

All right-of-ways through private property required shall be secured by the Owner. Contractor shall not start construction in right-of-ways until directed by the Engineer. No claim shall be made by the Contractor for damage due to delay in securing right-of-ways.
Furthermore, as per N.J.A.C. 7:14-2.5 the Owner shall be responsible to establish and confirm field control prior to start of construction.

1.09 TIME LIMITS

The Contractor agrees to start the work herein contracted for within ten (10) days from the date of the Engineer's Notice To Proceed to the Contractor directing him to proceed with the work. The time to complete the work contracted for, from the date of the Proceed Order, shall be limited to the following:

450 Calendar Days

No extension of time will be allowed for delay from any cause whatsoever, including normal weather conditions unless the Contractor shall have notified the Engineer in writing of such delay and his intention to claim an extension of time within two (2) days after the beginning of such delay. Such notice shall give complete information concerning the nature, extent and cause of the delay. If, in the opinion of the Owner, an extension of time is warranted the Owner or Owner's representative, will issue a written extension, setting a new time limit for the completion of the work. Additionally, should the Owner grant the Contractor an extension of Contract time, the Contractor shall not be due any compensation for the extended contract time unless specifically indicated in writing at the time of the extension. Failure of Owner or Owner's Representative to expressly respond to a reservation of rights letter from Contractor reserving a right to additional compensation shall in no way be deemed an admission that Contractor is entitled to additional fees. Any costs associated with increased contract time due to approved change order work must be specifically identified and included in the change order at the time of submission.

1.10 LIQUIDATED DAMAGES

In case the Contractor fails to complete the work contracted for, satisfactory to and acceptable to the Owner within the stipulated time limit, or violates any terms or conditions of said contract or the terms and conditions of P.L. 1971, c. 198 (C.40A:11-1 et seq., Local Publics Contract Law), then the Contractor shall and will pay to the Owner for each and every calendar day determined to be in default, the following sums, which are agreed upon, fixed and determined by the parties hereto to be liquidated damages. Liquidated damages shall not be assessed beyond substantial completion.

One (1) to Fifteen (15) Days beyond Contract Time Limits
Five Hundred ($500.00) dollars per calendar day.

Sixteen (16) to Thirty (30) Days beyond Contract Time Limits
One Thousand ($1,000.00) dollars per calendar day.

Greater than Thirty (30) Days beyond Contract Time Limits
Two Thousand ($2,000.00) dollars per calendar day

The Owner shall recover said damages by deducting the amount thereof out of any money which may be due or become due the Contractor, or by an action of law against the Contractor, his surety or by either or both of these methods.

In case the Contractor shall be delayed due to the failure on the part of the Owner to furnish anything on its part to be furnished or for any other cause beyond the control of the Contractor, he shall be entitled to such an extension of time for the delivery of equipment, materials, work and supplies as in the judgement of the Owner or Owner's representative to be fair and just.

1.11 OWNER'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

The Owner has the right to stop work or terminate the contract, if:

(a) The Contractor has violated the provisions of P.L. 1971 c. 198 (C:40A:11-1 et seq., Local Public Contracts Law),or any other Federal, State or Local law, or

(b) The Contractor shall be adjudged bankrupt or make an assignment for the benefit of creditors, or

(c) A receiver or liquidator shall be appointed for the Contractor or for any of his property and shall not be dismissed within 20 days after such appointment or the proceedings in connection therewith shall not be stayed on appeal within the said 20 days, or

(d) The Contractor shall refuse or fail, after notice or warning from the Engineer, to supply enough properly skilled workmen or proper materials, or

(e) The Contractor shall refuse or fail to prosecute to work or any part thereof with such diligence as will ensure its completion within the period herein specified (or any duly authorized extension thereof) or shall fail to complete the work within said period, or

(f) The Contractor shall fail to make prompt payment to persons supplying labor or materials for the work, or

(g) The Contractor shall fail or refuse to regard laws, ordinances or regulations or otherwise to be guilty of a violation of any provisions of the contract or the Scope of Work therein, then and in such event, the Owner, without prejudice or any rights or remedy it may have, may give seven (7) days notice to the Contractor to terminate the employment of the Contractor and his right to proceed, either as to the entire work or at the option of the Owner as to any portion thereof as to which delay shall have occurred, and may take possession of the work and complete the work by the Contractor or otherwise, as the Owner may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the compensation to be paid the Contractor hereunder shall exceed the expense of so completing the work, including compensation for additional managerial, administrative and inspection services and any damages for delay, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor and his sureties shall be liable to the Owner for such expenses. If the right of the Contractor to proceed with the work is terminated, the Owner may take possession of and utilize in completing the work such materials, appliances, supplies, drawings, and equipment, as may be on the site of the work and necessary therefore. If the Owner does not terminate the right of the Contractor to proceed, the Contractor shall continue the work. If the work shall be stopped by order of the Court or any other public authority, for a period of three (3) months without act or fault of the Contractor or of any of his agents, servants,

employees, or Subcontractor, the Contractor may, upon ten (10) days notice to the Owner, discontinue his performance of the work and/or terminate the contract, in which event the liability of the Owner to the Contractor shall be determined as provided in the paragraphs immediately preceding, except that the Contractor shall not be obligated to pay to the Owner any excess of the expense of completing the work over the unpaid balance of the compensation to be paid by the Contractor hereunder.

1.12 REFERENCE TO THE STANDARD SPECIFICATIONS

(a) All applicable portions of the work performed under this contract shall comply with the requirements of the current New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, as amended or supplemented and whose specifications are made part of these specifications. The New Jersey Department of Transportation Standard Construction Details shall govern except insofar as same are expressly modified, amended or changed in detail drawings prepared specifically for this particular project.

(b) The Standard Specifications are made part of these specifications by this reference as if were set forth in full. It is the responsibility of the prospective bidder to be familiar with these Standard Specifications. The Contractor is required to follow only the printed bound book of New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, 2007, unless modified in the technical specifications of this contract. Copies may be examined in the Engineer's office or may be purchased from the New Jersey Department of Transportation.

1.13 SED UTILIZATION REQUIREMENT

(a) Owner has completed the SED Utilization Plan and Form OEO-001, which are attached at the end of the general conditions.

(b) Anticipated SED participation to achieve the above goal may include the work that will be part of the Contractor’s scope of work as detailed in the attached SED Utilization Plan. The project sponsor has identified that the SED utilization goal for this project is 10 percent. A goal of not 10 percent (or a higher percentage as may be required by Federal law) of the total amount of all contracts for building, materials and equipment, or services for a project funded by a New Jersey environmental infrastructure facilities financing program must be awarded to SEDs.

(c) SED business concerns will be contacted by the Contractor by advertisement on trade websites such as Construction Information Systems and by contact via email and telephone based on the list provided by the NJDEP Office of Equal Opportunity & Public Contract Assistance. Bids will be solicited by the Contractor on an unrestricted basis. For each unrestricted contract, the project plan shall also identify the SED utilization requirements that the successful bidder shall meet.

(d) Owner will designate a project compliance officer who will coordinate SED utilization efforts for the project with the Contractor and will be responsible for monitoring and enforcement of compliance with the affirmative action and the SED requirements of the program’s rules. Their responsibilities will also include submittal of the Contractor’s monthly progress reports until the SED goals have been achieved. The project compliance officer will also be responsible for submitting quarterly construction reports for the life of the project. Quarterly reports will include the value of each contract and subcontract awarded to SED firms, percentage of SED utilization compared to the cost of each contract, types, sizes and nature of goods and services of the participating SED, and efforts made to publicize and promote the project sponsor’s SED utilization plan.

(e) The successful bidder must submit to the project sponsor and to the NJDEP Office of Equal Opportunity and Public Contract Assistance a Contractor’s SED Utilization Plan within 30 days of awarding of the contract. The Contractor’s Plan shall contain provisions to meet the specific SED utilization

requirements imposed upon the contractor by the project sponsor as well as to meet the general SED utilization requirements for the project pursuant to N.J.A.C. 7:22-9.

2.0 INSURANCE

2.01 STATE LAW AND REGULATIONS AND INSURANCE

The Contractor must assume all risks connected with his work. He shall comply with all State Laws and Regulations concerning Workmen's Compensation and shall maintain such insurance as will protect him against all claims for damages for personal injury, including death which may arise during prosecution of the contract, either by himself or by any Subcontractor or anyone directly or indirectly employed by either of them.

2.02 CONTRACTOR'S INSURANCE

The Contractor shall not commence work under this contract, until he has obtained all insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work, in his subcontract until all similar insurance required of the Subcontractor has been so obtained and approved.

Insurance coverage shall remain in effect until the project is accepted by the Owner, and at all times thereafter when the Contractor may be removing or replacing defective work.

The Contractor shall furnish the Owner with proof of insurance by execution of the Certificate of Insurance, of which a copy is included herein. The Owner, Remington & Vernick Engineers, the Owner’s Solicitor, the NJDEP and their agents shall be a named additional insured.

The Certificate of Insurance shall give the Owner and Engineer 30 days written notice of any material change in, cancellation of, or expiration of the policies.

The following types of insurance are required:

a. General Liability

b. Automobile Liability

c. Excess Liability

d. Worker's Compensation and Employer's Liability

The amounts for property damage and bodily injury for each type of insurance are as shown on the Certificate of Insurance herein.

The Contractor's insurance shall apply to and provide coverage for all Subcontractors and/or suppliers unless the Contractor forwards to the Owner and Engineer the Certificate of Insurance for the Subcontractor and/or supplier.

Any insurance company providing coverage must be licensed, admitted and authorized to do business in the State of New Jersey.

2.03 SUIT OR CLAIMS

The Contractor agrees to indemnify and save harmless the Owner and the Engineer and all their agents and employees from actions and suits of every kind and description brought against them, or on account of the use of patented rights, and from any damages or injuries received or sustained by any party, or parties, arising out of any act or omission of the Contractor, his workmen or agents in performance of the work under this agreement, including the furnishing of equipment, materials and supplies at the site of the proposed work.

2.04 DAMAGES TO PERSONS AND PROPERTY

Contractor shall fully and completely indemnify and same harmless the Owner from damages or injury to persons or property resulting from the performance of the work, or through negligence to the contract, or through the use of any improper or defective machinery implements or appliances or through any act of omission of the Contractor, or his agents, or his employees.

3.0 CONDUCT OF THE WORK

3.01 ROLE OF THE ENGINEER

The Engineer may verify, by observation and/or required tests, the amount, quality, acceptability and fitness of the materials, equipment and supplies furnished; and shall interpret any ambiguities in the drawings and specifications, contract documents, and any extra work order. Upon request, the Engineer shall confirm in writing any oral direction, requirement or determination.

All work of refilling sunken ditches, repaving over trenches and keeping the streets and sidewalks in passable condition shall be satisfactorily performed by the Contractor during the construction of the work as well as during the maintenance period. If any work is not done within 48 hours after written notice given by the Engineer, the work may be done by the Owner and charged to the Contractor.

3.02 SURVEYS

Unless otherwise expressly provided for in the specifications, the Contractor will furnish all surveys necessary for the execution of the work. The Owner will furnish a base line and datum bench marks as required. The Contractor shall measure and lay out his work and be responsible for the accuracy thereof from bench marks and base lines established by the Engineer which shall constitute the surveys hereinbefore referred to. The contractor shall submit cut sheets for curb, sidewalk and roadway construction projects unless specifically waived in writing by the Engineer.

3.03 PRESERVATION OF STAKES

The Contractor shall carefully preserve benchmarks, reference points and stakes, and in case of willful or careless destruction, he will be charged with the resulting expense and shall be responsible, for any mistakes that may be caused by their unnecessary loss or disturbance.

3.04 USES OF PREMISES AND REMOVAL OF DEBRIS

The Contractor expressly undertakes at his own expense:

(a) To take every precaution against injuries to persons or damage to property.

(b) To store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the administration of Owner's affairs.

(c) To place upon the work any part thereof only such loads as are consistent with the safety of that portion of the work.

(d) To frequently clean up all refuse, scrap material and debris caused by his operations and at all times the site of the work shall present a neat, orderly condition.

(e) Before final payment to remove all surplus material, false work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations and to put the site in a neat orderly condition.

(f) To affect all cutting, fitting, or patching of his work required to make the same conform to the drawings and specifications, and except with the consent of the Engineer, not to cut or otherwise alter the work.

3.05 INJURY TO EXISTING STRUCTURES

The Contractor shall be responsible for all injury to existing structures met within the prosecution of the work, including the delivery to the site of the proposed improvements of materials and supplies. In case of accident to existing structures met within the prosecution of the work, the Contractor will be required to immediately notify the proper authorities and as soon as possible thereafter also notify the Engineer.

3.06 CORRECTION OF WORK

The Contractor expressly warrants that his work shall be free from any defects in materials or workmanship and agrees to correct any such defects which may appear in such materials or workmanship within two years or the term of the maintenance bond, which ever is longer, following the final acceptance of the work by the Owner, such final acceptance to be evidenced by an appropriate resolution of the governing body in the case of municipal corporation, quasi municipal corporation, municipal board, municipal commission or other municipal authority or by the issuance of final payment in the case of any Owner other than a municipal corporation, quasi municipal corporation, municipal board, municipal commission or other municipal authority.

Neither the acceptance of the completed work, nor payment therefore shall operate to release the Contractor or his surety or sureties from any obligation or obligations under this contract or the bonds required under these Contract Documents.

3.07 PUBLIC UTILITIES

The contract drawings indicate the approximate location of known overhead and subsurface utilities in the vicinity of the work. The bidder is advised to investigate and ascertain for himself all the facts concerning the actual location of these utilities.

The Contractor shall cooperate with the utility Owners in the adjustment of their facilities and shall notify the utility Owners not less than ten (10) days in advance of the time he proposes to perform any work that will endanger or affect their facilities.

The Contractor shall permit the Owners of utilities, or their agents, access to the site of the work at all times in order to relocate, construct or protect their lines and he shall cooperate with them in performing this work.

Separate payments will not be made for the following:

1. Coordination and cooperation of the Contractor with the utility companies, nor for the protection or replacement of utilities as specified hereinbefore.

2. Damages for delay caused by conflicts with utilities outside the jurisdiction of the Owner (ex: gas mains, telephone or electric lines, county storm sewer, water mains, etc.).

The bidder shall include all such costs in the prices bid for the various scheduled items in the Bid form.

3.08 PROTECTION OF WORK AND PROPERTY

The Contractor shall continuously maintain adequate protection of his work and shall protect Owner's property from injury or loss arising in connection with his work. He shall also protect all adjacent property as provided by law and shall be responsible for all injury to property and existing structures sustained during the prosecution of his work, including delivery to the site of the equipment, materials and supplies. He shall repair and replace any such damage, injury or loss equal or better than the condition of the item prior to the Contractor's action.

All passageways, guard fences, light and other facilities required for protection by local authorities or local conditions must be provided and maintained.

3.09 CONTRACTOR TO ACT IN AN EMERGENCY

In case of any emergency which threatens loss or injury of property, and/or safety of life, the Contractor is required to act as he sees fit. He shall notify the Engineer thereof immediately thereafter.

3.10 EXTRA WORK

The Contractor further agrees that the Engineer may make such alterations as he may see fit in the form, dimensions, plans for materials of the work, materials and supplies bid upon or any part thereof, either before or after work. If such alterations diminish the quantity of the equipment, materials and supplies to be furnished and delivered to the site or work to be executed, they shall not constitute a claim for damages for anticipated profits on the work that may be dispensed with. If the extra work, change or alteration increases the amount of work to be performed or equipment, they shall be paid for at the price bid. If prices for such extra work are not included in the lump sum prices or unit prices bid, the Contractor hereby agrees to furnish the necessary materials and perform such labor as extra work and agrees to accept in full payment therefore a price which shall be fixed by the Engineer previous to its commencement. The basis of such estimated cost will be the actual cost of materials, labor, equipment, and a maximum 10 % overhead plus a maximum ten percent (10%) profit. Contractor shall furnish breakdown estimate for such extra work. these overhead and profit factors may be accepted by owners as reasonable in lieu of requiring the submission of additional supporting data. However, the owner must reserve its right to review any cost or profit element on a case-by-case basis, where the submission for overhead and profit is more than the 10 percent overhead and 10 percent profit indicated above. Payment for markup on subcontracted work shall be at a maximum rate of 5% of the total amount for all costs on the subcontracted work. For Extra Work in the amount of $ 10,000 to $ 100,000, the above factors may be included initially for equitable adjustments but will be subject to negotiation, cost and pricing data, and owner review requirements. Federally funded projects will be governed by Federal regulations. Change Orders and Open-End Contracts will be in accordance with N.J.A.C. 5:30-11 et seq. and 7:14-2.7.

The Contractor shall not be entitled to receive payment for any extra work unless the same is certified in writing by the Engineer.

3.11 DISPUTE RESOLUTION

For construction contracts, the Owner and Contractor agree that in the event of a dispute arising under this contract, it shall be submitted to a process of resolution pursuant to alternative dispute resolution practices, such as mediation, binding arbitration or non-binding arbitration pursuant to industry standards, prior to being submitted to a Court for adjudication. Nothing in this section shall prevent the contracting unit from seeking injunctive or declaratory relief in court at any time. The alternative dispute resolution practices shall not apply to disputes concerning the bid solicitation or award process, or to the formation of contracts or subcontracts to be entered to pursuant to P.L. 1971, c. 198 (C. 40A:11-1 et seq., Local Public Contracts Law).

Notwithstanding industry rules or any provision of law to the contrary, whenever a dispute concerns more than one contract, such as when a dispute in a contract involving design, architecture, engineering or management,

upon demand of a contracting party, other interested parties to the dispute shall be joined unless the arbitrator or person appointed to resolve the dispute determines that such a joinder is inappropriate. Notwithstanding industry rules or any provision of law to the contrary, whenever more than one dispute of a similar nature arises under a construction contract, or related construction contracts, upon demand of a contracting party, the disputes shall be joined unless the arbitrator or person appointed to resolve the dispute determines that the disputes are inappropriate for joinder.

4.0 CONTRACTOR'S PERSONNEL

4.01 PERSONAL ATTENTION

The Contractor shall give his personal supervision to the prosecution of the work, or have a competent representative on the work who shall have written authority to carry out the requirements of the Contract Documents. He shall also supply all manpower, materials and equipment as they may be required in the furnishing and delivery to the site of the proposed work, the equipment, materials and supplies bid upon.

4.02 CONTRACTOR'S SUPERINTENDENT

The Contractor shall attend to the work personally or through a competent, English-speaking superintendent, who shall be continually present on the project site whenever work is in progress. Such a superintendent shall be satisfactory to the Owner and Engineer and shall not be removed or replaced without due notice being given the Owner and Engineer. The Superintendent shall have full authority to act for the Contractor without the need to consult any higher level of authority.

4.03 LABOR LAWS

The Contractor and any Subcontractors shall comply with all the requirements of the Labor Laws of the State of New Jersey applicable to contracts on behalf of this Owner for construction, alteration or repair of any building or public work, including particularly, but without limitation of the foregoing, the provisions of N.J.S.A. 10:2-1 to 10:2-4, inclusive and N.J.S.A. 34:11-56.*25* et seq., New Jersey Prevailing Wage Act.

The Contractor hereby agrees to comply in all respect with the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et seq. as amended. A copy of the prevailing wage rates pertaining to the work and issued by the New Jersey Department of Labor entitled, "Prevailing Wage Rate Determination" is on file in the Engineer's office and is included herein. Pursuant to N.J.S.A. 34:11-56.25 et seq. – New Jersey Prevailing Wage Act, no public works contract may be awarded to any contractor and subcontractor or to any firm, corporation or partnership in which they have an interest on the attached disbarred bidders list located at the end of this specification, until expiration date given. Workmen shall be paid not less than such prevailing wage rate.

Before final payment is made by or on behalf of the Owner of any sum or sums due to the work, the Contractor or Subcontractor shall file with the treasurer of the Owner, written statements in form satisfactory to the Commissioner of Labor certifying to the amounts then due and owing from such contractor or subcontractor filing such statement to any and all workmen for wages due on account of the work, setting forth therein the names of the persons whose wages are unpaid and the amount due to each respectively which statement shall be certified by the oath of the Contractor or Subcontractor as the case may be in accordance with the said New Jersey Prevailing Wage Act.

The prevailing wage rate shall be determined by the Commissioner of Labor or his duly authorized representative.

Contractors or Subcontractors performing public work of a public body subject to the provisions of this act shall post the prevailing wage rates for each craft and classification involved as determined by the Commissioners of

Labor including the effective date of any changes thereof, in prominent and easily accessible places at the site of the work or at such place or places as are used by them to pay workmen their wages.

In the event it is found that any workmen, employed by the Contractor or any Subcontractor, on this project, has been paid a rate of wages less than the prevailing wage required, the Department of Labor along with the Owner may terminate the Contractor's or Subcontractor's right to proceed with the work or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise, the Contractor and his surety(ies) shall be liable to the Department of Labor along with the Owner for any excess costs occasioned thereby.

Prior to final payment, the Contractor shall be required to execute and deliver an Affidavit of Compliance in a form provided by the Engineer, as required by the Act.

4.04 CONTRACTOR'S EMPLOYEES

All workmen must be competent and fully qualified in the type of work to be performed. Any employee of the Contractor, who is found by the Engineer to be incompetent, or who is performing his work in an unsightly manner or contrary to the specifications or the Engineer's instructions, or who is disorderly, shall be removed from the project and shall not again be employed on the project without the Engineer's consent.

4.05 EIGHT HOUR DAY: PREVAILING WAGE RATE

All mechanics, workers, laborers, employed or engaged in the work hereunder shall work no more than eight (8) hours in any one day. In case of necessity for the protection of property or human life, mechanics, workmen and laborers may be employed for longer periods than eight hours per calendar day, if paid extra compensation on the basis of eight hours, constituting a days work, in accordance with the Prevailing Wage Act, N.J.S.A. 34:11-56-25 et seq., and all State and Federal laws.

4.06 PAYMENT OF EMPLOYEES

The Contractor and each of his Subcontractors shall pay each of his employees engaged in work on the project under this contract in full (less deductions made mandatory by law) in legal tender and not less often than once each month.

4.07 SAFETY AND HEALTH REGULATIONS

The Contractor shall comply with the Department of Labor, Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (P.L.91-596) and under Section 107 of the Contract Work Hours and Safety Standards for Construction (P.L.91-54).

4.08 ACCIDENT PREVENTION

Precautions shall be exercised at all times for the protection of persons (incl. employees) and property. The safety provisions of applicable laws, buildings and construction codes shall be observed. Machinery, equipment, and all hazards shall be guarded or eliminated in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Association General Contractors in America and Part VI "Temporary Traffic Control" of the U.S. Dept. of Transportation. Federal Highway Administration "Manual on Uniform Traffic Control Devices", latest edition, whichever is more stringent to the extent that such provisions are not in contravention of applicable law. Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances and methods and for any damage which may result from their failure for their improper construction, maintenance or operation. The cost of "Accident Prevention" shall be included in the lump sum or unit price bid whichever is applicable.

5.0 MATERIALS

5.01 CONTRACTOR'S TITLE TO MATERIALS

No materials or supplies for the work shall be purchased by the Contractor or by Subcontractor that are subject to any chattel mortgage or under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work.

5.02 ROYALTIES AND PAYMENTS

The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringements of any patent rights and shall save the Owner harmless from loss or account thereof.

5.03 USE OF DOMESTIC MATERIAL

In the performance of the work, the Contractor and all Subcontractors shall use only manufactured materials and farm products of the United States of America, wherever available.

All Contractors and Subcontractors shall comply with the provisions of N.J.S.A. 40A:11-18, which relate to the use of domestic materials.

5.04 ORDERING MATERIALS

Before ordering materials, the Contractor shall obtain the Engineer's approval of their conformity to the specifications. In the case of concrete aggregate, and similar materials, samples must accompany the request for approval. The Contractor must forward to the Engineer copies of all shipping lists, invoices or delivery slips accompanying such deliveries.

5.05 SAMPLES

The Contractor shall submit to the Engineer any samples of materials before or during the progress of the work that may be required by the Contract Documents and all materials and workmanship must be equal in every respect to the samples submitted and approved.

5.06 SHOP OR SETTING DRAWINGS

(a) The Contractor shall submit promptly eight copies, of which two will be returned to the contractor, of each shop or setting drawings prepared in accordance with the schedule predetermined under the provisions of the preceding paragraph hereof with the Contractor's approval stamp and date thereon. After examination of such drawings by the Engineer, and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Engineer with eight corrected copies. If requested by the Engineer, the Contractor must furnish additional copies, regardless of corrections made in or approval given to such drawings by the Engineer. The Contractor will nevertheless be responsible for the accuracy of such drawings and for their conformity to the drawings and specifications unless he notified the Engineer in writing of any deviations, at the time he furnished such drawings. Shop drawing requirements as detailed within the technical specifications and scope of work shall govern should they be in conflict with the General Conditions.

(b) The Contractor shall likewise submit, in writing, the type, kind and name of the manufacturer of all materials to be used in the work for the written approval of the Engineer prior to the installation of same.

(c) Any equipment or materials installed without this written approval of the Engineer will be required to be removed by the Contractor at his own expense and replaced with equipment and materials as approved.

5.07 ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

The Contractor will be furnished additional instructions and detail drawings to carry out the work included in the contract as required. The additional drawings and instructions thus supplied, to the Contractor, will coordinate with the contract documents and will be so prepared that they can be reasonably interpreted as a part thereof. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions.

The Contractor and the Engineer will prepare, jointly (a) a schedule fixing the date at which special drawings will be required and by whom they will be made, such drawings, if any, to be furnished by the Engineer in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop or setting drawings; the beginning of manufacture, testing and installation of materials, supplies and equipment and the completion of the various parts of the work, each such schedule to be subject to change from time to time in accordance with the progress of the work.

5.08 OR EQUAL CLAUSES

Wherever in these contract documents a particular brand, make of materials, device or equipment is shown or specified, such brand, make of material, device or equipment should be regarded merely as a standard.

When a bidder submits an equivalent, it shall be the responsibility of the bidder to document the equivalence claim.

Failure to submit such documentation shall be grounds for rejection of the claim of equivalence.

If two or more brands, makes of material, devices or equipment are shown or specified, each should be regarded as the equal of the other. Any other brand, make of material, devices or equipment, which in the opinion of the Engineer is the recognized equal of that specified, considering quality, workmanship and economy of operation, and is suitable for the purpose intended, will be accepted. All material and workmanship shall, in every respect be in accordance with what, in the opinion of the Engineer is in conformity with approved modern practice.

Whenever the drawings, specifications or other contract documents or the direction of the Owner or its authorized agent admit of doubt as to what is permissible, and/or fail to note the quality of any work, that interpretation will be made by the Engineer which is in accordance with approved modern practice to meet the particular requirement of the contract.

In all cases, new materials shall be used unless this provision is waived by notice from the Engineer.

5.09 SUBSTITUTIONS

After the execution of the contract, substitution of equipment or materials of makes other than those named in the contract will be considered for one reason only. That the equipment proposed for substitution is superior or equal in construction and/or efficiency to that named in the contract.

Complete data, to include: shop drawings, specifications, performance curves, test results, list of similar installation with years of service, operating and maintenance instruction, a statement that the Contractor agrees to pay all costs that will result directly or indirectly from acceptance of the substitute, and all other necessary information; shall be submitted in triplicate to enable the Engineer to evaluate the proposed substitution equipment or material. The determination as to whether or not such changes will be permitted rests solely with the Engineer.

The Contractor shall take and assume full responsibility and bear any extra expense or cost incurred by changes advocated by him. Those costs include, but are not limited to, review time by the Engineer or the Engineer's Consultants, costs of redesign, and claims of other contractors affected by the resulting change. It will be assumed that the cost to the Contractor of the equipment or materials proposed to be substituted is less than the equipment or materials named in the contract, and if the substitution is approved, the contract price shall be reduced by an amount equal to the savings.

5.10 MATERIAL SAFETY DATA

In accordance with the requirements of N.J.S.A. 34:5A-1 et seq., "Workers and Community Right to Know Act", the State Department of Health has adopted a Workplace Hazardous Substance List (N.J.A.C. 8:59-9) which includes substances that pose a threat to the health and safety of employees. Therefore, under the provisions of N.J.A.C. 8:59-7, the contractor must furnish the Owner a "Material Safety Data Sheet" for each product which is supplied to the Owner which contains a substance listed on the Hazardous Substance List (N.J.A.C. 8:59-9). The Owner reserves the right to request a copy of the applicable Material Safety Data Sheet be forwarded with the delivery of each product. Furthermore, under the provisions of N.J.A.C. 8:59-5, each product shall have a label affixed or stenciled onto any container that contains any substance listed on the Hazardous Substance List (N.J.A.C. 8:59-9).

6.0 INSPECTION AND TESTING

6.01 INSPECTION

The Contractor shall afford every facility for inspection of the equipment, materials and supplies at all times by the Engineer prior to the delivery of same to the site of the work. All equipment, supplies and materials shall be tested in the presence of the Engineer, if so desired.

Any equipment, materials, supplies or workmanship deemed of inferior quality, or not in accordance with the finally approved specifications, brought to or incorporated in the work may be rejected by the Engineer. The equipment, materials and supplies and workmanship may be re-inspected at any time, prior to delivery to the site of the proposed improvements. The Contractor shall bear all the expense of testing materials.

When construction is not continuous through the normal work week, (Monday through Friday), Contractor must notify the Engineer at least 24 hours in advance of any stopping or starting of the work. Notification may be by writing, telephone, facsimile, telegraph or personal visit to the Engineer's listed office.

Contractor shall notify Engineer at least forty-eight (48) hours in advance to any work on Saturdays. There will be no work permitted on Sundays or holidays. If the project receives inspection by the Engineer, the normal working hours for the Engineers inspector are from 7:30 a.m. to 4:00 p.m., Monday through Friday. Any overtime inspection costs for the Engineers inspector which are avoidable shall be reimbursed by the Contractor.

Should the contractor have an emergency or need to cancel scheduled work, notification of the cancelled work must be received by the Engineer's inspector no later than 6:00 am the morning of the cancellation. Failure of the contractor to provide the required notification will require the contractor to pay for eight (8) hours of inspection at the rate of the Engineer's local inspector. The costs for cancellation of inspection without the required notification will be deducted from the contractor's payment application.

As the Owner is only paying for the contract time in the Contract Documents, the Contractor shall be responsible for all costs of inspection and contract management beyond the contract time limits, unless a written extension of time has been granted by the Owner. These costs are in addition to any liquidated damages that may be charged to the Contractor.

6.02 DAILY REPORTS

On a daily basis, the Contractor shall have his Authorized Representative complete, sign and present the Engineer with a Certificate of Site Safety Conditions, attached hereto as Form GC-6.02S.

At the Engineers discretion, the Contractor may be directed to furnish a daily report, on a form, which will include the date, the weather, a general description of the work performed, line item quantities involved, number and skill type of workers, equipment utilized, location of work, and any pertinent remarks affecting the work.

6.03 INSPECTORS

The work shall be conducted under the general observation of the Engineer through such Inspectors as the Engineer employs. Inspectors are stationed on the site of the work to represent the Engineer and to report to him concerning the observation of progress of the work and the workmanship and materials being furnished. Such Inspectors shall inform the Engineer and the Contractor when they observe that work being performed and/or the materials being furnished do not conform to the requirements of the Contract Documents. Such observation, if and when provided, shall not relieve the Contractor of any responsibility to furnish materials and perform work in complete accordance with the requirements of the Contract Documents, nor does such observation create any duty or obligation to any employee or invitee of Contractor, any Subcontractor, or to any third party.

The Inspector is not authorized to revoke, alter, enlarge, relax or release any requirements of the Contract Documents or to issue instructions contrary to the Contract Documents.

The Project Sponsor will employ one, or more if warranted by the scope of the project, environmental inspector(s) to ensure that the requirements of these specifications relating to environmental and cultural resource protection and restoration are effectively carried out. Individuals designated as environmental inspectors by the project sponsor must possess, at a minimum, the education/experience qualifications of an Environmental Specialist employed with the Department. The Department will also conduct environmental inspections to oversee the conduct of the protection/restoration measures. Responsibilities of the project sponsor's environmental inspector(s) include the following:

1. Daily inspections of active work areas and periodic inspection of maintenance or restoration areas sufficient to ensure performance of protection measures in accordance with contract documents.

2. The maintenance of a daily job diary in which they shall record the progress of the work and of any problems encountered. The environmental inspectors shall notify the Contractor in writing immediately upon noticing that environmental specifications are not being met.

3. At frequent intervals during construction, the recipient, the resident engineer, the environmental inspector and the Department inspectors shall meet to review progress and to resolve difficulties that might result in unnecessary delays in the work. The Department shall notify the recipient if deficiencies are not immediately corrected. The recipient shall then direct compliance with the environmental requirements.

After the award of a contract and prior to the start of construction, a preconstruction meeting shall be held with the Owner, Contractor, Engineer, Inspectors and NJDEP Representatives per N.J.A.C. 7:22-3.17 (a) 26. Then during construction, jobs meetings will be held according to N.J.A.C. 7:22-3.17 (a) 30.

6.04 ACCESS TO THE WORK

The Contractor shall furnish the Engineer with every reasonable facility for observing the work as performed.

The Engineer shall have the right to inspect all work done and all materials furnished either in the field or at the point of manufacture. The Contractor shall furnish or cause to be furnished safe access at all times to the places where preparation, fabrication or manufacture of materials and/or construction of the work is in progress.

When the Engineer or his representative are in or about the premises mentioned above in the course of their duties, they shall be deemed conclusively to be an invitee of the Contractor. If the Contractor is not the Owner of the premises mentioned above, the Owner thereof shall be deemed an agent of the Contractor with respect to the obligation assumed hereby. The Contractor or his agent, as described above, shall be liable for the payment of claims for injuries, damages, etc, for death of the Owner or his representative due to the negligence on the part of the Contractor or his agent.

6.05 COVERING UNINSPECTED WORK

If any work be buried, covered or otherwise concealed prior to observation by Engineer or contrary to the orders and direction of the Engineer and such work is not subject to testing and approval by any acceptable alternate method it must, if required by the Engineer, be uncovered for examination. Such uncovering and all necessary restoration regardless of the final acceptability of the work, uncovered, shall be at the expense of the Contractor.

6.06 TESTING MATERIALS

Except as may be provided elsewhere, tests or analysis of materials which are usually tested after delivery to the site, such as concrete aggregate, mixed-in-place concrete, and similar materials; will be performed by the Engineer or testing laboratories which will be approved by the Engineer and selected and paid for by the Contractor. The preliminary testing of concrete mixtures and tests or analysis of other materials, samples of which are to be submitted prior to delivery, will also be performed by the laboratory and paid for by the Contractor at the Engineer's request.

If the Engineer orders sampling and analysis or tests of materials which are usually accepted on certification of the manufacturer but which appear defective or not conforming to the requirements of the Specifications, the Contractor will bear the reasonable costs of sampling, transportation, tests and analysis.

7.0 PAYMENTS

7.01 CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Engineer an estimated construction progress schedule in form satisfactory to the Engineer, showing proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due to the Contractor in accordance with the progress schedule. The Contractor shall update the schedule each time a change is approved, but at a minimum every 30 days. An updated schedule shall be submitted with the Contractor's payment application. Should a payment application be submitted without an updated schedule, payment processing may be delayed. The Contractor shall also furnish the Engineer (a) a detailed estimate giving a complete breakdown of the contract price on Lump Sum Contracts and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules are to be used in determining the basis of partial payments.

Approval of the progress schedule by the Engineer does not modify the Contract or constitute Acceptance of the feasibility of the Contractor's logic, activity durations, or assumptions used in creating the schedule. If the schedule reflects a completion date different than that defined by the date of Notice to Proceed and Contract Time, this does not change the specified completion date. If the Engineer approves a schedule that reflects a completion date earlier than that specified as the Contract Time, the Owner will not accept claims for additional Contract Time or compensation as the result of failure to complete the Work by the earlier date shown on the

progress schedule. Float is the amount of time that an activity may be delayed from its early start without delaying Completion. Float belongs to the Project and is not for the exclusive use of the Contractor or the Owner.

7.02 PAYMENTS

Unless otherwise specified, on the first day of each month or within thirty (30) days thereafter, the Engineer will estimate approximately the value of the work performed, and equipment, materials and supplies delivered on the ground inspected and accepted during the preceding month, according to these specifications, less any retainage, and shall be certified by the Engineer for payment to the Contractor. The value of the work, as estimated, will be determined by the lump sum and/or unit price bid. Where any specific item(s) in the partial payment estimate is in dispute; the engineer may delete those costs from the estimate and approve the acceptable portion of the payment request. Payment requested for stored materials and/or equipment shall be subject to the following conditions being met or satisfied:

1. The materials and/or equipment shall be received in a condition satisfactory for incorporation in the work.
2. The materials and/or equipment shall be stored in such manner that they will not be damaged due to weather, construction operations or any other cause.
3. An invoice from the supplier shall be furnished for each item on which payment is requested.
4. The contractor shall furnish written proof from the supplier of 90 percent payment for the materials and/or equipment no later than 30 days after receipt of payment for same from the owner. The owner shall have the right to deduct from the next payment estimate an amount equal to the payment for said material and/or equipment if reasonable and adequate proof is not submitted.

Requests for payment for materials on hand shall be accompanied with receipted invoice from supplier. Prior to such payment being made, the Contractor shall execute an agreement, provided by the Engineer and Solicitor on behalf of the Owner, which details the conditions of payment.

If, in the opinion of the Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the contract documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgment of the Engineer shall be equitable.

No request for payment shall be approved until a Certification of Site Safety Conditions showing no unsafe conditions for each day worked in the payment request period has been furnished by the Contractor. When the work performed under this contract has been completed by the Contractor and accepted by the Owner, the Engineer shall make a final estimate of the work and certify the same to the Owner which shall for causes herein specified, pay to the Contractor the balance due, excepting therefrom such sum as may be lawfully retained under any provisions of this contract. All prior estimates and payments including those relating to extra work shall be subjected to corrections by this payment.

The Owner shall pay the amount due to the prime contractor for each periodic payment, final payment or retainage monies not more than 30 calendar days after the billing date, except as provided herein, which for periodic billing shall be established at the pre-construction meeting and memorialized in the minutes of the pre-construction meeting. The billing shall be deemed approved and certified 20 days after the Owner or Owner's Representative receives it, as indicated by the date stamped received on the billing by the Owner or Owner's Representative, except as provided herein, unless the Owner or Owner's Representative provides, before the end of the 20-day period, a written statement of the amount withheld and the reason for withholding payment. The Owner is a public or governmental agency that requires the governing body to vote on authorizations for each periodic payment, final payment or retainage monies, the amount due may be approved and certified at the next scheduled public meeting of the Owner's governing body and paid during the Owner's subsequent payment cycle.

7.03 RETAINAGE

The Contractor is advised that for contracts of $100,000.00 and under for improvement to real property, the sum of 10% of the amount due shall be held on each partial payment pending completion of the project.

The Contractor is advised that the Local Public Contracts Law, N.J.S.A. 40A:11-1 et seq., are applicable if the total amount of the contract awarded for this project exceeds $100,000.00. The provisions of N.J.S.A. 40A:11-1 et seq., provide that the Contractor may:

1. Agree to the withholding of payments in the manner prescribed in the contract, or may deposit with the contracting unit registered book bonds, entry municipal bonds, State bonds or other appropriate bonds of the State of New Jersey, or negotiable bearer bonds or notes of any political subdivision of the State, the value of which is equal to the amount necessary to satisfy the amount that otherwise would be withheld pursuant to the terms of the contract. The nature and amount of the bonds or notes to be deposited shall be subject to approval by the contracting unit. For the purposes of this section, "value" shall mean par value or current market value, whichever is lower.

2. Such agreement will be indicated by signing of estimate or payment certificates unless written communication to the contrary is made to the Owner and Engineer, or If the Contractor agrees to the withholding of payments, the amount withheld shall be deposited, with a banking institution or savings and loan association insured by an agency of the Federal Government, in an account bearing interest at the rate currently paid by such institutions or associations on time or savings deposits. The amount withheld, or the bonds or notes deposited, and any interest accruing on such bonds or notes, shall be returned to the contractor upon fulfillment of the terms of the contract relating to such withholding, Any interest accruing on such cash withholdings shall be credited to the Owner.

Furthermore, N.J.S.A. 40A:11-1 et seq. provides that for contracts over $100,000.00 for improvement to real property:

1. From the total amounts due as ascertained through a current Engineer's estimate will be deducted an amount equivalent to two percent (2%) of the amount due on each partial payment shall be withheld by the Owner pending completion of the contract.

2. Upon acceptance of the work performed pursuant to the contract for which the contractor has agreed to the withholding of payments pursuant to this section, all amounts being withheld by the Owner shall be released and paid in full to the contractor as required by law after final acceptance by the Owner, without further withholding of any amounts for any purpose whatsoever, provided that the contract has been completed as indicated.

7.04 ACCEPTANCE OF FINAL PAYMENT AS RELEASE

The acceptance by the Contractor of final payment shall be and shall operate as the Contractor's release of the Owner from all claims and all liability to the Contractor, other than claims in stated amounts as may be specifically excepted by the Contractor, for all things done or furnished in connection with the work and for every act and neglect of the Owner, or Owners designee and others relating to or arising out of this work. Any payment, however, final or otherwise, shall not release the Contractor or its sureties from any obligations under the contract documents, and/or arising out of performance of the work, and/or arising out of the obligations undertaken by the surety under performance, payment and/or maintenance bonds.

7.05 OWNER'S RIGHT TO WITHHOLD PAYMENTS

Owner may withhold from the Contractor as much of any approved payments due him, as may, in the judgment of the Owner, be necessary to

(a) Secure the payment of just claims then due and unpaid by any persons supplying labor or materials for the work.

(b) Protect the Owner from loss due to defective work not remedied, or

(c) Protect the Owner from loss due to injury to persons or damage to the work or property of other Contractors, Subcontractors or others caused by the act or neglect of the Contractor or any of his Subcontractors that the Owner may deem proper to satisfy such claims or to secure such protection. Such application of such money shall be deemed payment for the amount of the Contractor.

(d) Protect the Owner from enforcement action by others or from being in non-compliance with laws or regulations due to the failure of the Contractor to supply the Engineer and or Owner with Monthly Manning Reports, Certified Payroll Reports or other submittals required by the Engineer or Owner.

7.06 COSTS OF ENGINEERING AND INSPECTION

There will be deducted from the contract and retained by the Owner an amount to defray the cost of wages and overhead paid by the Owner to the Resident Engineer, Inspector or Inspectors employed on the work for any avoidable time in excess of eight (8) hours per day or on Saturdays, Sundays or legal holidays. This amount shall be determined at the rate of the hourly rate contract with the Owner per man hour for each Inspector or Resident Engineer for, in excess of 8 hours per day and at the rate of the hourly rate contract with the Owner per man hour for Saturday, Sunday and Holidays for each Inspector or Resident Engineer.

In addition, there will be deducted from the contract and retained by the Owner an amount equal to the cost paid by the Owner to the Engineer, for all inspection and contract administration performed in excess of the completion time stipulated for the contract, or as amended by approved change orders.

7.07 LIENS

Final payment of retained percentage shall not become due until the Contractor, shall furnish the Owner a complete release of liens arising out of his contract, or receipts in full, in lieu thereof covering claims of any kind or character for work or labor done, or labor or materials furnished by the Subcontractor, materialmen, persons or corporations whatsoever. The form attached entitled “Full Release and Waiver of Liens” shall be submitted with the final voucher prior to final payment.

7.08 PREVAILING WAGE PAYMENT CERTIFICATE

The form attached hereto, entitled "Prevailing Wage Payment Certification" shall be executed by the Contractor and submitted with the final voucher prior to final payment.

7.09 CERTIFIED PAYROLL REPORTS

The Contractor shall submit original certified payroll reports within 10 days of the payment of wages to the Owner with a copy to the Owners designee, in compliance with N.J.A.C. 12:60.

8.0 VALUE ENGINEERING CONSTRUCTION CHANGE ORDERS

8.01 IMPLEMENTATION OF VALUE ENGINEERING

In accordance with N.J.S.A. 40A:11-16.6 a contractor may submit a Value Engineering Construction Proposal (VECP) after the award of a contract for a project for structures or other improvements to real property, other than work affecting a public building, that exceed $5,000,000. This includes most public works projects, such

as utility and environmental systems, road construction and repair, etc., but not building construction, improvements, or renovation. A VECP is a cost reduction proposal based on analysis by a contractor of the functions, systems, equipment, facilities, services, supplies, means and methods of construction, and any other item needed for the completion of the contract consistent with the required performance, quality, reliability, and safety.

8.02 STATUTORY PROVISIONS

a. Value engineering construction change orders shall not be used to impair any of the essential functions, or characteristics of the project, or any portion of the work involved.

b. The contractor shall submit a value engineering construction proposal that completely describes the changes to the original specifications or proposal, impact on other project components, advantages and disadvantages of the proposed change, cost estimates and calculations on which they are based, any impact on the contract time schedule, and any other relevant information that the contracting unit may require in order to review the value engineering construction proposal. The contractor's cost for developing the value engineering construction proposal shall not be eligible for reimbursement by the contracting unit.

c. The contractor shall be liable for all reasonable costs incurred by the contracting unit for the technical evaluation and engineering review of a value engineering construction proposal presented by the contractor.

d. The contracting unit's engineer shall prepare a written report for the governing body that shall evaluate the value engineering construction proposal, make a recommendation on whether or not it should be accepted, rejected, or modified, and state to the contracting unit and contractor the amount of any projected cost savings.

e. The proposal shall not be approved unless the engineer reports to the governing body that the proposal appears consistent with the required performance, quality, reliability, and safety of the project and does not impair any of the essential functions, or characteristics of the project, or any portion of the work involved.

f. The contracting unit shall have the sole discretion to approve or disapprove a value engineering construction proposal.

g. The contractor and the contracting unit shall equally share in the cost savings generated on the contract as a result of an approved value engineering construction change order. Once the project is completed, the contracting unit's engineer shall verify the cost savings to reflect the actual cost of the work, and such verified cost saving shall be the basis for the savings shared equally with the contractor.

h. The contractor shall have no claim against the contracting unit as a result of the contracting unit's disapproval of a value engineering construction proposal.

8.03 PROCEDURES

An initial submission is required to use the Value Engineering process. The initial proposal shall outline the general technical concepts associated with the proposal and the estimated savings that will result.

The initial proposal will be reviewed by the Owner and, if found to be conceptually acceptable, approval to submit a final proposal will be granted by the Owner. A finding of conceptual acceptability of the initial proposal in no way obligates the Owner to approve the final proposal. The Contractor shall have no claim against the Owner as a result of the rejection of any such final proposal.

Final proposals will be considered only after Owner approval of the initial proposal. Final proposals will not be considered if submitted after 50 percent completion of the Work has occurred, based on monthly estimates

amounting to more than 50 percent of the total Contract price (subject to any approved adjustments), unless the remaining Contract Time is one year or more.

Proposals will not be considered that change the following:

a. The type, thickness, or joint designs of a concrete, or HMA surface, intermediate, or base course.

b. The types and thicknesses of the unbound materials underlying a concrete, or HMA surface, intermediate, or base course.

c. The basic design of bridges, defined as the type of superstructure and substructure, span length type and thickness of deck, type of beam and arrangement, geometrics, width, and under-clearance.

d. The basic design of retaining walls.

e. The basic design of overhead sign supports, and breakaway sign supports.

f. The type of noise barriers.

g. Special architectural aesthetic treatments of structures.

All proposals for changes to bridges and structures shall conform to the current AASHTO Standard Specifications for Highway Bridges as modified by the NJDOT Design Manual for Bridges and Structures.

As a minimum, the following materials and information shall be submitted with each final proposal plus any additional information requested by the Owner:

a. A statement that the final proposal is submitted as a Value Engineering proposal.

b. A description of the difference between the existing Contract requirements and the proposed change, and the comparative advantages and disadvantages of each, including considerations of safety, service life, economy of operations, stage construction, ease of maintenance, and desired appearance.

c. Complete plans, specifications, and calculations showing the proposed revisions relative to the original Contract features and requirements. If the proposal is approved, the Contractor shall submit drawings, in ink, on polyester film such as Mylar or Herculene, 4 mils thick, matted on both sides except as follows:

   (1) Structural drawings may be submitted in pencil.

   (2) Electrical drawings may be matted on one side and may be submitted in pencil.

   (3) Cross-section sheets may be 3 mils thick and may be matted on one side.

   All plans and engineering calculations shall bear the signature of a Professional Engineer licensed to practice in the State.

d. A complete cost analysis indicating the final estimated costs and quantities to be replaced by the proposal, the new costs and quantities generated by the final proposal, and the cost effects of the proposed changes on operational, maintenance, and other considerations.

e. A specific date by which a Change Order adopting the final proposal must be executed so as to obtain the maximum cost reduction during the remainder of the Contract. This date must be selected to allow the Owner ample time, usually a minimum of 45 days, for review and processing a Change Order. Should the Owner find that insufficient time is available for review and processing, it may reject the final proposal solely on such basis.

f. A statement as to the effect the final proposal has on the Contract Time.

g. A description of any previous use or testing of the final proposal on another Owner project or elsewhere and the conditions and results therewith. If the final proposal was previously submitted on another Owner project, indicate the date, the project, and the action taken by the Owner.

h. The proposal shall not be experimental in nature but shall have been proven to the Owner's satisfaction under similar or acceptable conditions on another Owner project or at another location acceptable to the Owner.

Proposals will be considered only after Award of Contract and only when all of the following conditions are met:

a. The Contractor is cautioned not to base any bid prices on the anticipated approval of a proposal and to recognize that such proposal may be rejected. In the event of rejection, the Contractor is required to complete the Contract according to the original Plans and Specifications and the prices initially bid and accepted by the Governing Body.

b. All proposals, approved or not approved by the Owner for use in the Contract, apply only to the ongoing Contract or Contracts referenced in the proposal. The proposals shall become the property of the Owner and shall contain no restrictions imposed by the Contractor on their use or disclosure. The Owner will have the right to use, duplicate, and disclose in whole or in part any data necessary for the utilization of the proposal. The Owner retains the right to use any accepted proposal or part thereof on any other or subsequent project without any obligation to the Contractor. This provision is not intended to deny rights provided by law with respect to patented materials or processes.

c. If the Owner already has under consideration certain revisions to the Contract that are subsequently incorporated in a proposal, the Owner will reject the Contractor's proposal and may proceed with such revisions without any value engineering obligation to the Contractor.

d. The Contractor shall make no claim against the Owner or Owner's agents for any costs or delays due to the Owner's rejection of a proposal, including but not limited to development costs, anticipated profits, or increased materials or labor costs resulting from delays in the review of such proposal.

e. The Engineer will determine whether a proposal qualifies for consideration and evaluation. The Owner may reject any proposal which is not consistent with the basic design criteria for the Project.

f. The Engineer may reject all or any portion of Work performed pursuant to an approved proposal if the Engineer determines that unsatisfactory results are being obtained. The Engineer may direct the removal of such rejected Work and require the Contractor to proceed according to the original Contract requirements without reimbursement for any Work performed under the proposal, or for its removal. Where modifications to the proposal are approved to adjust to field or other conditions, reimbursement is limited to the total amount payable for the Work at the Contract prices as if it were constructed according to the original Contract requirements. Such rejection or limitation of reimbursement does not constitute the basis of any claim against the Owner for delay or for any other costs.

g. Proposals will be considered only if equivalent options are not already provided in the Contract Documents.

h. The proposal shall be made based on items of work scheduled to be done by the Contractor. Anticipated cost savings based on revisions of utility relocations or other similar items to be done by others will not be considered. Proposals that may increase the cost of Work done by others may be considered.

i. If additional information is needed to evaluate proposals, this information must be provided in a timely manner. Such additional information could include, where design changes are proposed, results of field investigations and surveys, design computations, and field change sheets.

The contracting unit's engineer shall prepare a written report for the governing body that shall evaluate the value engineering construction proposal, make a recommendation on whether or not it should be accepted, rejected, or modified, and state to the contracting unit and contractor the amount of any projected cost savings.

a. The proposal shall not be approved unless the Engineer reports to the Owner's governing body that the proposal appears consistent with the required performance, quality, reliability, and safety of the project and does not impair any of the essential functions, or characteristics of the project, or any portion of the work involved.

b. If the Owner fails to respond to the final proposal by the date specified, the Contractor shall consider the final proposal rejected and shall make no claim against the Owner as a result thereof.

c. The Owner shall have the sole discretion to approve or disapprove a value engineering construction proposal.

If the proposal is accepted, the changes will be authorized by Change Order. Payment will be made as follows:

a. The changes will be incorporated into the Contract by adjustments in the quantities of Pay Items, agreed upon Extra Work Items or by Force Account, as appropriate, according to the Specifications.

b. Once the project is completed, the contracting unit's engineer shall verify the cost savings to reflect the actual cost of the work, and such verified cost saving shall be the basis for the savings shared equally with the contractor. The costs of such verification shall be borne equally by both parties.

c. The Owner's costs for review and processing of the proposal will be deducted from the savings. The cost of the Engineer to verify the savings shall be apportioned equally between the parties.

d. A Contractor's costs for development, design, and implementation of the proposal are not eligible for reimbursement.

e. The Contractor may submit proposals for an approved Subcontractor, provided that reimbursement is made by the Owner to the Contractor and that the terms of the remuneration to the Subcontractor are satisfactorily negotiated and accepted before the proposal is submitted to the Owner. Subcontractors may not submit a proposal except through the Contractor.

9.0 DIFFERING SITE CONDITIONS PROVISIONS (P.L. 2017, c. 317)

a. Differing Site Conditions Provisions:

(1) If the contractor encounters differing site conditions during the progress of the work of the contract, the contractor shall promptly notify the contracting unit in writing of the specific differing site conditions encountered before the site is further disturbed and before any additional work is performed in the impacted area.

(2) Upon receipt of a differing site conditions notice in accordance with Section 9.0(a)1 of this subsection, or upon the contracting unit otherwise learning of differing site conditions, the contracting unit shall promptly undertake an investigation to determine whether differing site conditions are present.

(3) If the contracting unit determines different site conditions that may result in additional costs or delays exist, the contracting unit shall provide prompt written notice to the contractor containing directions on how to proceed.

(4) (a) The contracting unit shall make a fair and equitable adjustment to the contract price and contract completion date for increased costs and delays resulting from the agreed upon differing site conditions encountered by the contractor.

(b) If both parties agree that the contracting unit's investigation and directions decrease the contractor's costs or time of performance, the contracting unit shall be entitled to a fair and equitable downward adjustment of the contract price or time of performance.

(c) If the contracting unit determines that there are no differing site conditions present that would result in additional costs or delays, the contracting unit shall so advise the contractor, in writing, and the contractor shall resume performance of the contract, and shall be entitled to pursue a differing site conditions claim against the contracting unit for additional compensation or time attributable to the alleged differing site conditions.

(5) Execution of the contract by the contractor shall constitute a representation that the contractor has visited the site and has become generally familiar with the local conditions under which the work is to be performed.

(6) As used in this subsection, "differing site conditions" mean physical conditions at the contract work site that are subsurface or otherwise concealed and which differ materially from those indicated in the contract documents or are of such an unusual nature that the conditions differ materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for in the contract.

b. Suspension of Work Provisions:

(1) The contracting unit shall provide written notice to the contractor in advance of any suspension of work lasting more than 10 calendar days of the performance of all or any portion of the work of the contract.

(2) If the performance of all or any portion of the work of the contract is suspended by the contracting unit for more than 10 calendar days due to no fault of the contractor or as a consequence of an occurrence beyond the contracting unit's control, the contractor shall be entitled to compensation for any resultant delay to the project completion or additional contractor expenses, and to an extension of time, provided that, to the extent feasible, the contractor, within 10 calendar days following the conclusion of the suspension, notifies the contracting unit, in writing, of the nature and extent of the suspension of work. The notice shall include available supporting information, which information may thereafter be supplemented by the contractor as needed and as may be reasonably requested by the contracting unit. Whenever a work suspension exceeds 60 days, upon seven days' written notice, either party shall have the option to terminate the contract for cause and to be fairly and equitably compensated therefore.

(3) Upon receipt of the contractor's suspension of work notice in accordance with Section 9.0(A)2 of this subsection, the contracting unit shall promptly evaluate the contractor's notice and promptly advise the contractor of its determination on how to proceed in writing.

(4) (a) If the contracting unit determines that the contractor is entitled to additional compensation or time, the contracting unit shall make a fair and equitable upward adjustment to the contract price and contract completion date.

(b) If the contracting unit determines that the contractor is not entitled to additional compensation or time, the contractor shall proceed with the performance of the contract work, and shall be entitled to pursue a suspension of work claim against the contracting unit for additional compensation or time attributable to the suspension.

(5) Failure of the contractor to provide timely notice of a suspension of work shall result in a waiver of a claim if the contracting unit can prove by clear and convincing evidence that the lack of notice

or delayed notice by the contractor actually prejudiced the contracting unit's ability to adequately investigate and defend against the claim.

c. Change in Character of Work Provisions:

(1) If the contractor believes that a change directive by the contracting unit results in a material change to the contract work, the contractor shall so notify the contracting unit in writing. The contractor shall continue to perform all work on the project that is not the subject of the notice.

(2) Upon receipt of the contractor's change in character notice in accordance with paragraph (1) of this subsection, the contracting unit shall promptly evaluate the contractor's notice and promptly advise the contractor of its determination on how to proceed in writing.

(3) (a) If the contracting unit determines that a change to the contractor's work caused or directed by the contracting unit materially changes the character of any aspect of the contract work, the contracting unit shall make a fair and equitable upward adjustment to the contract price and contract completion date. The basis for any such price adjustment shall be the difference between the cost of performance of the work as planned at the time of contracting and the actual cost of such work as a result of its change in character, or as otherwise mutually agreed upon by the contractor and the contracting unit prior to the contractor performing the subject work.

(b) If the contracting unit determines that the contractor is not entitled to additional compensation or time, the contractor shall continue the performance of all contract work, and shall be entitled to pursue a claim against the contracting unit for additional compensation or time attributable to the alleged material change.

(4) As used in this subsection, "material change" means a character change which increases or decreases the contractor's cost of performing the work, increases or decreases the amount of time by which the contractor completes the work in relation to the contractually required completion date, or both.

d. Change in Quantity Provisions:

(1) The contracting unit may increase or decrease the quantity of work to be performed by the contractor.

(2) (a) If the quantity of a pay item is cumulatively increased or decreased by 20 percent or less from the bid proposal quantity, the quantity change shall be considered a minor change in quantity.

(b) If the quantity of a pay item is increased or decreased by more than 20 percent from the bid proposal quantity, the quantity change shall be considered a major change in quantity.

(3) For any minor change in quantity, the contracting unit shall make payment for the quantity of the pay item performed at the bid price for the pay item.

(4) (a) For a major increase in quantity, the contracting unit or contractor may request to renegotiate the price for the quantity in excess of 120 percent of the bid proposal quantity. If a mutual agreement cannot be reached on a negotiated price for a major quantity increase, the contracting unit shall pay the actual costs plus an additional 10 percent for overhead and an additional 10 percent for profit, unless otherwise specified in the original bid.

(b) For a major decrease in quantity, the contracting unit or contractor may request to renegotiate the price for the quantity of work performed. If a mutual agreement cannot be reached on a

negotiated price for a major quantity decrease, the contracting unit shall pay the actual costs plus an additional 10 percent for overhead and an additional 10 percent for profit, unless otherwise specified in the original bid; provided, however, that the contracting unit shall not make a payment in an amount that exceeds 80 percent of the value of the bid price multiplied by the bid proposal quantity.

(5) As used in this subsection, the term "bid proposal quantity" means the quantity indicated in the bid proposal less the quantities designated in the project plans as "if and where directed."

10.0 SUPPLEMENTAL CONDITIONS
GENERAL CONDITIONS

Under Section **1.0 GENERAL PROVISIONS** add the following**:**

1.13 CONTRACTOR'S RESPONSIBILITY

The Contractor must submit a plan within 30 days of the contract award detailing how the SED Utilization Requirements will be met. The Contractor's Plan will include statements of how the SED Participation Requirement shall be achieved over the duration of the project. Additional guidance on implementation of SED Requirements are contained in the Supplementary Conditions.

1.14 OWNER'S RESPONSIBILITY

The Owner is required by N.J.A.C. 7:22-3.17(a)24 and N.J.A.C. 7:22-6.17(a)24 to insure that no less than 10 percent of the total amount of all contracts related to this project to be awarded to SEDs.

Under Section **2.0 INSURANCE**, subsection 2.02 CONTRACTOR'S INSURANCE, add the following:

The recipient shall certify that it and its contractors and subcontractors shall comply with all insurance requirements of the Fund loan agreement and certify, when appropriate, that the insurance is in full force and effect and that the premiums have been paid. The recipient shall include the State and its agencies, employees and officers as additional "named insureds" on any certificate of liability insurance (or other similar document evidencing liability insurance coverage) of the contractor. The recipient shall provide the Department with such certificate of liability insurance (or other similar document evidencing liability insurance coverage) prior to the issuance of the notice to proceed with the project. Such certificate shall be maintained in full force and represent a continuing obligation to include the State and its agencies, employees and officers as additional "named insureds" through the completion of construction. The recipient shall not alter or cancel such certificate without prior notification to the Department, in writing, 15 days in advance of any alteration or cancellation. The recipient shall comply with each requirement of this subsection prior to the release of the initial Fund loan disbursement for building the project.

Under Section **5.0 MATERIALS**, subsection 5.08 OR EQUAL CLAUSES, add the following:

In accordance with N.J.S.A. 40A:11-13(d), the furnishing of any "brand name," but may in all cases require "brand name or equivalent," except that if the goods or services to be provided or performed are proprietary, such goods or services may be purchased by stipulating the proprietary goods or services in the bid specification in any case in which the resolution authorizing the contract so indicates, and the special need for such proprietary goods or services is directly related to the performance, completion or undertaking of the purpose for which the contract is awarded.

Under Section **6.0 INSPECTION AND TESTING**, subsection 6.01 INSPECTION, add the following:

The Contractor shall assist the Owner's Engineer with record information as specified. In accordance with N.J.A.C. 7:14-2.2, "The Owner shall be responsible for the preparation of all record drawings required for

sewer lines. This responsibility may be delegated to the Owner's representative with adequate compensation for this service. This responsibility shall not be delegated to the Contractor. The Contractor shall assist the Owner/Engineer, by providing record information, when requested, during the progress of the work".

Under Section **6.0 INSPECTION AND TESTING**, subsection 6.03 INSPECTORS, add the following:

The Project Sponsor will employ one, or more if warranted by the scope of the project, environmental inspector(s) to ensure that the requirements of these specifications relating to environmental and cultural resource protection and restoration are effectively carried out. Individuals designated as environmental inspectors by the project sponsor must possess, at a minimum, the education/experience qualifications of an Environmental Specialist employed with the Department. The Department will also conduct environmental inspections to oversee the conduct of the protection/restoration measures. Responsibilities of the project sponsor's environmental inspector(s) include the following:

1. Daily inspections of active work areas and periodic inspections of maintenance or restoration areas sufficient to ensure performance of protection measures in accordance with contract documents.

2. The maintenance of a daily job diary in which they shall record the progress of the work and of any problems encountered. The environmental inspectors shall notify the Contractor in writing immediately upon noticing that environmental specifications are not being met.

3. At frequent intervals during construction, the recipient, the resident engineer, the environmental inspector and the Department inspectors shall meet to review progress and to resolve difficulties that might result in unnecessary delays in the work. The Department shall notify the recipient if deficiencies are not immediately corrected. The recipient shall then direct compliance with the environmental requirements.

After the award of a contract and prior to the start of construction, a preconstruction meeting shall be held with the Owner, Contractor, Engineer, Inspectors and NJDEP Representatives per N.J.A.C. 7:22-3.17 (a) 26. Then during construction, jobs meetings will be held according to N.J.A.C. 7:22-3.17 (a) 30.

Under Section **6.0 INSPECTION AND TESTING**, subsection 6.05 ACCESS TO WORK, add the following:

Representatives of New Jersey Department of Environmental Protection(NJDEP), the Owner and their Engineer shall have access to all work while in preparation of progress, off or on the site and the Contractor and all subcontractors shall provide proper and safe facilities therefore, including but not limited to ladders, scaffolds and protective equipment. The Owner, NJDEP or any of their duty authorized representatives shall have access to any such books, documents, papers and records relevant to the project maintained by the Contractor and all subcontractors for the purpose of making audit examinations, excerpts and transcriptions. The Contractor and all subcontractors shall preserve and maintain such records during project construction and for a minimum of three years after final payment by the NJDEP. The Contractor's facilities and records shall also be subject at all reasonable times to inspection and audit by Owner and NJDEP and their duly authorized representatives during the period of performance of the contract work and three (3) years thereafter.

Under Section **7.0 PAYMENTS**, subsection 7.02 PAYMENTS add the following:

In accordance with 7:14-2.8, at least 20 days before each monthly progress payment falls due for approval (but not more often than once per month), the contractor will submit to the engineer a partial payment estimate filled out and signed by the contractor covering the work performed during the period covered by the partial payment estimate and supported by such data as the engineer may reasonably require. Where any specific item(s) in the partial payment estimate is in dispute, the engineer may delete those costs from the estimate and approve the acceptable portion of the payment request. Payment requested for stored materials and/or equipment shall be subject to the following conditions being met or satisfied:

1. The materials and/or equipment shall be received in a condition satisfactory for incorporation in the work.

2. The materials and/or equipment shall be stored in such a manner that they will not be damaged due to weather, construction operations or any other cause.

3. An invoice from the supplier shall be furnished for each item on which payment is requested.

The contractor shall furnish written proof from the supplier of 90 percent payment for the materials and/or equipment no later than 30 days after receipt of payment for same from the owner. The owner shall have the right to deduct from the next payment estimate an amount equal to the payment for said material and/or equipment if reasonable and adequate proof is not submitted.

Under Section **7.0 PAYMENTS**, subsection 7.10 MOBILIZATION add the following**:**

In accordance with N.J.A.C. 7:14-2.9, mobilization shall consist of the cost of initiating the contract. Payment for mobilization will be made at the lump sum price bid for this item in the proposal, which price shall include the cost of initiating the contract. The provisions for payment for the item mobilization supersede any provisions elsewhere in the specifications for including the costs of these initial services and facilities in the prices bid for the various items scheduled in the proposal. The lump sum price bid for mobilization shall be payable to the contractor whenever he shall have completed 10 percent of the work of the contract. For the purposes of this item, 10 percent of the work shall be considered completed when the total of payments earned, exclusive of the amount bid for this item, shown on the monthly certificates of the approximate quantities of work done, shall exceed 10 percent of the total price bid for the contract. The lump sum price bid for mobilization is limited to the following maximum amounts:

Original Contract Amount (including Mobilization)

From More Than	To and Including	Maximum Amount for Mobilization
$ 0	$ 100,000	$ 3,000
100,000	500,000	15,000
500,000	1,000,000	30,000
1,000,000	2,000,000	60,000
2,000,000	3,000,000	90,000
3,000,000	4,000,000	120,000
4,000,000	5,000,000	125,000
5,000,000	6,000,000	150,000
6,000,000	7,000,000	175,000
7,000,000	10,000,000	200,000
10,000,000	--	2.5% of Amount Bid

PREVAILING WAGE PAYMENT CERTIFICATION

This form must be executed by Contractor and submitted with final voucher prior to final payment.

PROJECT _____

TO _____
(NAME OF OWNER AS IT APPEARS IN CONTRACT)

RE: Contract for Certification of Contractor of Payment of Prevailing Wages to Workmen Pursuant to New Jersey Prevailing Wage Act. Chapter 150 Laws of 1963 of New Jersey and all other claims.

The undersigned Contractor hereby certifies that any and all workmen employed by the undersigned Contractor and all Subcontractors have been paid in full and prevailing wages for their respective crafts or trades as determined and computed by the Commissioner of Labor and Industry, of the State of New Jersey, and that all suppliers and material men have been paid in full all amounts claimed by them, and there remains no outstanding claim, lien, or dispute; nor any contingent claim by any of the foregoing:

DATED: _____ _____
CONTRACTOR

STATE OF NEW JERSEY

COUNTY OF _____

_____ , being duly sworn according to law, upon his oath disposes and says that he is the _____ (Owner-pres. or authorized agent) of _____ (name of corporation) that he has read the aforesaid statement of certification and knows the content thereof, and that the same is true of his own knowledge and this affidavit is being executed by him pursuant to the New Jersey Prevailing Wage Act (Chapter 150 of Laws of 1963).

_____
Signature

Sworn and subscribed to
before me this _____day of _____ 20____,

_____
Notary Public of New Jersey

CERTIFICATION OF SITE SAFETY CONDITIONS

Form GC-6.02S

TOWN: _____ PROJECT NAME: _____

COUNTY: _____ JOB #: _____

I hereby certify that site safety conditions and the means and methods of construction have been and are in accord with the provisions of the Contract Documents and all requirements contained and referenced therein since the last executed Certificate of Site Safety Conditions, except as noted:

☐ Unsafe Trench Condition ☐ Unsafe Entry to Live Manhole

☐ Unsafe Traffic Control ☐ Unsafe Equipment

☐ Inadequate Fall Protection ☐ Proximity to Electric

☐ Other _____

_____

☐ None _____

Comments/Resolutions _____

_____

Contractor: _____

by: _____
Authorized Representative

I executed this form at _____ on _____.
Time Date

FULL RELEASE AND WAIVER OF LIENS

WHEREAS**,** the undersigned is a subcontractor, supplier or other person furnishing work, services, materials or equipment upon real estate owned by (OWNER) in (MUNICIPALITY), State of New Jersey in furtherance of that certain (PROJECT NAME) sponsored by the (OWNER) (hereinafter referred to as "Owner").

Receipt is acknowledged of $ _____, which represents full payment, for work, services, materials and/or equipment furnished and installed by us at the above referenced project, the undersigned does hereby waive, release and relinquish the Owner and the Building/Land from any and all claims and/or construction liens pursuant to N.J.S.A. 2A:44A-1 *et seq.* relating to this Project, to the extent of $ _____.

We agree to hold the Owner and the Building/Land harmless against any claim made or lien filed by any of our material suppliers and subcontractors who performed work or supplied materials for the Project to-date.

In addition, the undersigned warrants: (a) that any claims for payment for work, services, materials and/or equipment furnished in the construction or repair of the aforesaid real estate and improvements have not been assigned; (b) that all laborers, subcontractors and suppliers of the undersigned who have furnished work, services, materials and/or equipment in the construction or repair of the aforesaid real estate and improvements have been fully paid and that none of such laborers, subcontractors or suppliers have or will have any claim, demand or lien against the aforesaid real estate and improvements; and (c) that no financing statement, chattel mortgage, security interest, conditional bill of sale or retention of title agreement has been given or executed or will be given or executed for or in connection with any materials, appliances, machinery, fixtures or furnishings placed upon or installed, or to be placed upon or installed, in the aforesaid real estate and improvements by the undersigned.

IN WITNESS WHEREOF, the undersigned has executed and sealed this Full Release and Waiver of Liens this

_____ day of _____, 20.

Paid to date: $ _____

NAME OF SUBCONTRACTOR/SUPPLIER: _____

By: _____

Title: _____

Sworn and subscribed to

before me this _____ day of _____ 20____,

_____

Notary Public of New Jersey

APPENDIX A

MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE
N.J.S.A. 10:5-31 et seq. (P.L. 1975, C. 127)
N.J.A.C. 17:27

CONSTRUCTION CONTRACTS
(REVISED 4/10)

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, up-grading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. l7:27-7.2; provided, however, that the Division may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B and C, as long as the Division is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Division, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. l7:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award,

seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et. seq. as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

(1) To notify the public agency compliance officer, the Division, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;

(2) To notify any minority and women workers who have been listed with it as awaiting available vacancies;

(3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;

(4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contactor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite

skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Division. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Division, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Division.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Division and submitted promptly to the Division upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Division an initial project workforce report (Form AA 201) electronically provided to the public agency by the Division, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Division and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the-job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or other documents to the Division of Public Contracts Equal Employment Opportunity Compliance as may be requested by the Division from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Division of Public Contracts Equal Employment Opportunity Compliance for conducting a compliance investigation pursuant to **Subchapter 10 of the Administrative Code (NJAC 17:27)**.

APPENDIX B

DEBARMENT LEGAL INFORMATION

N.J.A.C. 7:1D-2.2 Causes for debarment

(a) The Department of Environmental Protection shall debar a person in the public interest for any of the following causes:

1. Commission of a criminal offense as an incident to obtaining or attempting to obtain a public or private contract, or subcontract thereunder, or in the performance of such contract or subcontract;

2. Violation of the Federal Organized Crime Control Act of 1970, or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, perjury, false swearing, receiving stolen property, obstruction of justice, or any other offense indicating a lack of business integrity or honesty;

3. Violation of the Federal or State antitrust statutes, or of the Federal Anti-Kickback Act (18 U.S.C. 874, 40 U.S.C. 276b, c);

4. Violations of any of the laws governing the conduct of elections of the State of New Jersey or of its political subdivisions;

5. Violation of the Law Against Discrimination (P.L. 1945, c.169, C.10:5-1 et seq., as supplemented by P.L. 1975, c.127), or of the act banning discrimination by industries engaged in defense work in the employment of persons therein (C.114, L.1942, C.10:1-10 et seq.);

6. Violations of any laws governing hours of labor, minimum wage standards, prevailing wage standards, discrimination in wages, or child labor;

7. Violations of any laws governing the conduct of occupations or professions or regulated industries;

8. Willful failure to perform in accordance with contract specifications or within contractual time limits;

9. A record of failure to perform or of unsatisfactory performance in accordance with the terms of one or more contracts, provided that such failure or unsatisfactory performance has occurred within a reasonable time preceding the determination to debar and was caused by acts within the control of the person debarred;

10. Violation of contractual or statutory provisions regulating contingent fees;

11. Any other cause affecting responsibility as a State contractor of such serious and compelling nature as may be determined by the department to warrant debarment, including such conduct as may be prescribed by the laws or contracts enumerated in this paragraph even if such conduct has not been or may not be prosecuted as violations of such laws or contracts;

12. Debarment by some other department or agency in the executive branch.

N.J.A.C. 7:22 – 3.39 – Debarment

a) No recipient shall enter into a contract for work on environmental infrastructure facilities with any person debarred, suspended or disqualified from Department contracting pursuant to N.J.A.C. 7:1D-2.

b) Recipients shall insert in every contract for work on a project a clause stating that the contractor may be debarred, suspended or disqualified from contracting on any project financially assisted by the State or the Department if the contractor commits any of the acts listed in N.J.A.C. 7:1D-2.

c) The recipient, prior to acceptance of Fund loan moneys, shall certify that no contractor or subcontractor is included on the State Treasurer's list of debarred, suspended and disqualified bidders as a result of action by a State agency in addition to that of the Department. If Fund loan moneys are used for disbursement to a debarred firm, the Department reserves the right to immediately terminate (N.J.A.C. 7:22-3.44) the Fund loan and/or take such other action pursuant to N.J.A.C. 7:1D-2 as is appropriate.

d) Whenever a bidder is debarred, suspended, or disqualified from Department contracting pursuant to N.J.A.C. 7:1D-2, the recipient may take into account the loss of Fund loan moneys under these regulations which result from awarding a contract to such bidder, in determining whether such bidder is the lowest responsive and responsible bidder pursuant to laws, and the recipient may advise prospective bidders that these procedures shall be followed.

e) Any person included on the State Treasurer's list as a result of action by a State agency, who is or may become a bidder on any contract which is or will be funded by a Fund loan under this subchapter, may present information to the Department why this section shall not apply to such person. If the Department determines that it is essential to the public interest and files a finding thereof with the New Jersey Attorney General, the Department may grant an exception from the application of this section with respect to a particular contract, in keeping with N.J.A.C. 7:1D-2.9. In the alternative, the Department may suspend or debar any such person, or take such action as may appropriate, pursuant to N.J.A.C. 7:1D-2.

N.J.A.C. 7:22 – 4.39 – Debarment

a) No recipient shall enter into a contract for work on environmental infrastructure facilities with any person debarred, suspended or disqualified from Department contracting pursuant to N.J.A.C. 7:1D-2.

b) Recipients shall insert in every contract for work on a project a clause stating that the contractor may be debarred, suspended or disqualified from contracting on any project financially assisted by the State or the Department if the contractor commits any of the acts listed in N.J.A.C. 7:1D-2.2.

c) The recipient, prior to acceptance of Trust loan moneys, shall certify that no contractor or subcontractor is included on the State Treasurer's list of debarred, suspended and disqualified bidders as a result of action by a State agency in addition to that of the Department of Environmental Protection. If Trust loan moneys are used for disbursement to a debarred firm, the Trust reserves the right to immediately terminate (N.J.A.C. 7:22-4.44) the Trust loan and/or take such other action pursuant to N.J.A.C. 7:1D-2 as is appropriate.

d) Whenever a bidder is debarred, suspended or disqualified from Department contracting pursuant to N.J.A.C. 7:1D-2, the recipient may take into account the loss of Trust loan moneys under these regulations which result from awarding a contract to such bidder, in determining whether such bidder is the lowest responsive and responsible bidder pursuant to law, and the recipient may advise prospective bidders that these procedures shall be followed.

e) Any person included on the State Treasurer's list as a result of action by a State agency, who is or may become a bidder on any contract which is or shall be funded by a Trust loan under this subchapter, may present information to the Trust why this section should not apply to such person. If the Trust determines that it is essential to the public interest and files a finding thereof with the New Jersey Attorney General, the Trust may grant an exception from the application of this section with respect to a particular contract, in keeping with N.J.A.C. 7:1D-2.9. In the alternative, the Trust may suspend or debar any such person, or take such action as may be appropriate, pursuant to N.J.A.C. 7:1D-2.

APPENDIX C

CONTRACT MODIFICATION & ACCEPTANCE

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

1. ISSUING OFFICE	2. PROJECT NO.	3. CONTRACT NO.	4. MODIFICATION NO.
5. TO (CONTRACTOR)		6. PROJECT LOCATION AND DESCRIPTION	

7. A proposal is required for making the hereinafter described change in accordance with specification and drawing revisions cited herein or listed in attachment hereto. Submit your proposal in space indicated on page 2, attach detailed breakdown of prime and sub-contract costs (See the clause of this contract entitled, "Changes". DO NOT start work under this proposed change until you receive a copy signed by the Contracting Officer or a directive to proceed).

Date	Type Name and Title	Signature

8. DESCRIPTION OF CHANGE: *Pursuant to the clause of this contract covering changes, the contractor shall furnish all labor and material, and all work necessary to accomplish the following described work*:

As a result of the above, the contract price is revised as follows:

ITEM NO.	ITEM DESCRIPTION	UNIT PRICE	ESTIMATED QUANTITY	TOTAL COST

TOTAL COST OF THIS MODIFICATION $ _____

The contract time is hereby: *increase* ☐ *decrease* ☐ or *remains the same* ☐ by _____ calendar days as a result of this modification.

The foregoing modification is hereby accepted:

CONTRACTOR	OWNER	(NJPE SEAL) ENGINEER
BY: _____	BY: _____	BY: _____
DATE: _____	DATE: _____	DATE: _____

APPROVAL:

STATE OF NEW JERSEY	DATE

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

9. ISSUING OFFICE	10. PROJECT NO.	11. CONTRACT NO.	12. MODIFICATION NO.

13. CONTRACTOR'S PROPOSAL – CHANGE IN CONTRACT PRICE
(Detailed breakdown, attach additional sheets as necessary)

(Proposed)

NET INCREASE	NET DECREASE	CALENDER DAYS INCREASE
$ _____	$ _____	_____ DAYS

DATE:	TYPE NAME AND TITLE:	SIGNATURE:

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

14. ISSUING OFFICE & PROJECT NO.	15. CONTRACT NO.	16. MODIFICATION NO.

17. ORIGINAL CONTRACT BID PRICE ……. $ _____
TOTAL OF PREVIOUS CHANGE ORDERS ……. $ _____
TOTAL CONTRACT COST INCLUDING CHANGE ORDERS … $ _____

18. NECESSITY FOR CHANGE AND REASON FOR OMISSION FROM PLANS AND SPECIFICATIONS:

19. OTHER IMPACTS RESULTANT OF THIS CHANGE:

20. RESUME OF NEGOTIATIONS OR RECOMMENDATIONS (Loanee's Representative) :

DATE:	TYPE NAME AND TITLE OF LOANEE'S REPRESENTATIVE:	SIGNATURE:

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

Use of the Change Order Form entitled "Contract Modification Proposal and Acceptance"

- When the Loanee wishes to issue a change to the contract, the attached "Contract Modification Proposal and Acceptance" form should be used as a request for proposal. Upon final settlement of the change, this same form is then completed and serves as the contract modification.
- The Loanee in requesting a proposal for a change would execute items 1 thru 8 (exclusive of the revised contract price and duration data) and 9 thru 12. Pages 1 and 2 of this form are then forwarded to the contractor, specifying scope of work and requesting the contractor's proposal.

The contractor should execute page 2 of the form, He then submits pages 1 and 2 of the form as his proposal, attaching additional sheets as necessary to provide his detailed breakdown of costs.

- Upon negotiation of a final settlement, the Loanee completes page 1 of the form, and all concerned parties (Contractor, Engineer, Owner) sign this document as the contract modification.
- Page 3 of the form is executed by the Loanee for documentation of the change, and to provide the necessary details for review by the Regulatory Agencies.
- Submit a minimum of one original with raised engineer's seal and one copy. It is suggested that one original be kept for your records.

Detailed Instructions for Executing "Contract Modification Proposal and Acceptance" Form

Item 1. Enter the name of the Loanee.

Item 2. Enter State Project number.

Item 3. Enter the contract number or designation.

Item 4. Enter the number identifying this modification.

Item5. Enter the name of the Contractor.

Item 6. Enter the project title and location.

Item 7. Requests a proposal for the specified change order work, but does not direct contractor to proceed. The owner or his authorized representative must execute this statement by signature with date and title blocks entered.

Item 8. Provide a clear description of the scope of work for this change. Upon final settlement of the modification costs, enter cost data by line item for unit priced items or by sum; and state total cost of this modification — net increase, decrease or no change in contract price. Enter appropriate information for any change in contract time, including number of calendar days involved. The modification is executed when all appropriate signatures are included.

Items 9—12 Same as items 1— 4.

Item 13. Executed by the contractor, stating net effect of change in appropriate box for money and time. A detailed breakdown must be provided in this item; and appropriate signature of authorized representative of contractor included.

Item 14. Enter the Loanee's name and State Project number. Item 15.

Enter the contract number or designation.

Item 16. Enter number identifying this modification. Item 17.

Enter appropriate financial data.

Item 18 Explain and justify the reasons for this change order

Item 19. Explain all other impacts resulting from this change with estimate of costs involved. This should include impact on other contractors and the Consulting Engineers.

Item 20. Document that negotiations were held as required by the regulations and explain the events leading to the final settlement in price and time, This statement should include, at a minimum, date and location of negotiations, persons attending, summary of negotiations leading to final price and time settlements, and a statement that the agreed-to price is "fair and reasonable".

APPENDIX D

SOCIALLY AND ECONOMICALLY DISADVANTAGED SUPPLEMENTARY SECTIONS

The rule below includes the amendments adopted to this subchapter on January 3, 2006.

Subchapter 9. Awarding Contracts for State Assisted Projects to Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals

7:22-9.1 Scope and purpose

(a) This subchapter establishes procedures for providing opportunities for socially and economically disadvantaged ("SED") contractors and vendors to supply materials and services under State financed construction contracts for environmental infrastructure facilities. To implement the policies established in N.J.S.A. 58:11B-26, 40:11A-41 et seq., and 52:32-17 et seq., this subchapter applies to environmental infrastructure projects receiving financial assistance from the Department and the Trust pursuant to N.J.A.C. 7:22-3, 4 and 6 and 7:22A-6 and 7. Under the provisions of N.J.A.C. 7:22-3, 4 and 6 and 7:22A-6 and 7, the Department and the Trust require recipients of Trust and Fund loans and other assistance to establish such programs for socially and economically disadvantaged small business concerns, to designate a project compliance officer, and to submit to the Department and Trust procurement plans for implementing the SED program. In addition, N.J.A.C. 7:22-3.17(a)24, 4.17(a)24, 6.17(a)24 and 7:22A-2.4(a) provide that a goal of not less than 10 percent be established for the award of contracts to small business concerns owned and controlled by one or more socially and economically disadvantaged individuals. The goal of 10 percent applies to the total amount of all contracts for building, materials and equipment, or services (including planning, design and building related activities) for a construction project. Where a local government unit has a SED participation goal which exceeds 10 percent of the total amount of all contracts, the local government unit must comply with both the Department's rules and the local minority and women-owned business ordinances.

(b) This subchapter also establishes the standards and procedures that will apply to the contracting agencies of grant or loan recipients in the awarding and making of contracts under their SED programs.

7:22-9.2 Definitions

The following words and terms, as used in this subchapter, will have the following meanings unless the content clearly indicates otherwise.

"Building" means the acquisition, erection, alteration, remodeling, improvement or extension of an environmental infrastructure facility.

"Construction" includes, but is not limited to:

1. The preliminary planning to determine the economic and engineering feasibility of environmental infrastructure facilities, the engineering, architectural, legal, fiscal, and economic investigations and studies, surveys, design, plans, working drawings, specifications, procedures, and other action necessary for the construction of environmental infrastructure facilities;

2. The building of, or purchase of land for, environmental infrastructure facilities; and

3. The inspection and supervision of the building of environmental infrastructure facilities.

"Contract" means any written agreement with a professional service or construction contractor related to the construction of an environmental infrastructure project.

"Contracting agency" means:

1. The governing body of a local government unit or any department, branch, board, commission, committee, authority, agency or officer of such local government unit possessing the authority to award and make contracts; or

2. The owner(s) or authorized representative(s) of a private entity.

"Contractor" means any party entering into a contract to provide or offering to provide building, materials and equipment, or services to a project sponsor for the construction of environmental infrastructure facilities. This includes, but is not limited to, planning and design, as well as building related services such as engineering, inspection and accounting.

"Contractor's plan" means the SED utilization plan submitted by the contractor to the project sponsor and to the Department establishing subcontracting opportunities that will fulfill the requirements of this subchapter.

"Department" means the New Jersey Department of Environmental Protection and its successors and assigns.

"Environmental infrastructure facilities" means wastewater treatment facilities, stormwater management facilities or water supply facilities.

"Financial agreement" means the legal instrument, including a grant agreement or loan agreement, executed between either the State of New Jersey or the Trust and the project sponsor for the construction of environmental infrastructure facilities.

"Local government unit" means a county, municipality, municipal or county sewerage or utility authority, municipal sewerage district, joint meeting, improvement authority or other political subdivision of the State authorized to construct, operate and maintain wastewater treatment or stormwater management facilities, or a State authority, district water supply commission, county, municipality, municipal or county utilities authority, municipal water district, joint meeting or any other political subdivision of the State authorized pursuant to law to operate or maintain a public water supply system or to construct, rehabilitate, operate or maintain water supply facilities or otherwise provide water for human consumption.

"New Jersey environmental infrastructure financing program" means the program for providing financing to project sponsors pursuant to N.J.A.C. 7:22-3, 4 and 6, and 7:22A-6 and 7.

"Office" means the Office of Equal Opportunity and Public Contract Assistance or other program of the Department of Environmental Protection with the responsibility for administration of this subchapter.

"Private entity" means the owner(s) of a nongovernmental community water system or a nonprofit noncommunity water system.

"Project" means the defined services for the construction of specified operable environmental infrastructure facilities as approved by the Department or the Trust in the project sponsor's financial agreement.

"Project compliance officer" means an officer or employee of the project sponsor who is designated by the project sponsor to monitor and enforce compliance with the affirmative action and SED requirements of the applicable program rules and this subchapter.

"Project plan" means the proposal submitted at the time of application by the project sponsor to the Department establishing the SED utilization plan and its requirements.

"Project sponsor" means any local government unit or private entity that seeks a loan or grant pursuant to N.J.A.C. 7:22-3, 4 and 6 and 7:22A-6 and 7.

"SED utilization plan" means a written document outlining the entire project work, the estimated length of time it will take to complete the project, each significant segment of the project on which SEDs will or may participate, and a description of how SEDs will be contacted.

"Socially and economically disadvantaged small business concern" or "SED" means any small business concern:

1. Which is at least 51 percent owned by one or more socially and economically disadvantaged individuals; or, in the case of a publicly owned business, at least 51 percent of the stock of which is owned by one or more socially and economically disadvantaged individuals; or, in the case of a joint venture, at least 51 percent of the beneficial ownership interests are legitimately held by a SED; and

2. Whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals; and

3. Which is a full participation subcontractor in that the SED is responsible for the execution of a distinct element of work and carries out the work responsibility by actually performing, managing and supervising the task involved. Any deviation from this definition will automatically classify the SED as a broker, middleman or passive conduit. These three functions are contrary to the spirit of the Trust Act and will not qualify a SED enterprise for State of New Jersey certification; and

4. Which has been certified pursuant to the New Jersey Uniform Certification Act (N.J.S.A. 52:27H-1 et seq.) or pursuant to the provisions of 49 CFR Part 23 by the New Jersey Commerce and Economic Growth Commission, the New Jersey Department of Transportation, the Port Authority of New York and New Jersey, the New Jersey Transit or other agencies deemed appropriate by the Office, as an eligible minority business or female business.

i. "Socially disadvantaged individuals" means those individuals who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities.

ii. "Economically disadvantaged individuals" means those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged.

iii. "Socially and economically disadvantaged individuals" shall include women, Black Americans, Hispanic Americans, Native Americans, Asian Americans, and members of other groups, or other individuals, found to be socially and economically disadvantaged by the Small Business Administration under Section 8(a) of the Small Business Act, as amended (15 USC 637(a)). Black Americans, Hispanic Americans, Native Americans and Asian Americans shall be defined as follows:

(1) "Black American" means a person having origins in any of the black racial groups in Africa;

(2) "Hispanic American" means a person of Spanish or Portuguese culture, with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;

(3) "Asian American" means a person having origins in any of the original peoples of the Far East, Southeast Asia, Indian Subcontinent, Hawaii, or the Pacific Islands;

(4) "Native American" means a person having origins in any of the original peoples of North America.

"Small business concern" means a business which is independently owned and operated and which is not dominant in its field of operation. A business is independently owned and operated if the management which controls the business is responsible for both its daily and long term operations.

"Subcontract" means an agreement to perform a portion of a contract.

"Subcontractor" means a third party that is engaged by the contractor to perform part of the work under a subcontract.

“10 percent SED utilization,” “10 percent goal” and “10 percent” means SED business concern participation, which includes 7 percent for minority-owned SED business concerns and 3 percent for women-owned SED business concerns.

"Trust" means the New Jersey Environmental Infrastructure Trust established pursuant to the Trust Act.

"Trust Act" means the New Jersey Environmental Infrastructure Trust Act (N.J.S.A. 58:11B-1 et seq.), as amended and/or supplemented.

7:22-9.3 SED utilization requirements for projects

(a) A goal of not less than 10 percent (or a higher percentage as may be required by Federal law) of the total amount of all contracts for building, materials and equipment, or services for a project funded by a New Jersey environmental infrastructure facilities financing program must be awarded to SEDs.

(b) The 10 percent SED utilization requirement shall be accomplished by the following:

1. Bids shall be solicited on an unrestricted basis. The bid documents, however, shall include a statement to the effect that the successful bidder must fulfill the SED utilization requirements by subcontracting portions or the work to SEDs; or

2. Contractors also have the option of establishing unrestricted bidding procedures to fulfill the 10 percent SED utilization requirement for the project.

7:22-9.4 Requirement to develop SED Utilization Plan

(a) Each project sponsor shall develop, in consultation with the Office, a plan for achieving its SED utilization requirements (the "project plan"). Development of a plan shall be completed before the Department and, when relevant, the Trust may approve an application pursuant to the applicable program rules

(b) The project plan shall identify those contracts proposed to be bid on an unrestricted basis. For each unrestricted contract, the project plan shall also identify the SED utilization requirements that the successful bidder shall meet.

(c) All contractors, including SED contractors, shall submit their own SED utilization plan ("contractor's plan"), for the aspects of the project covered by the contract, to the project sponsor and to the Office within 30 days of the awarding of a contract. The Contractor's Plan shall contain provisions to meet the specific SED utilization requirements imposed upon the contractor by the project sponsor as well as to meet the general SED utilization requirements for the project pursuant to this subchapter.

(d) If the contractor does not comply with the requirements of the contractor's plan and the project sponsor does not take steps to otherwise comply with N.J.A.C. 7:22-9.3(a), the Department and, in the case of a Trust loan, the Trust, may take any of the actions or combinations thereof specified in N.J.A.C. 7:22-3.40 through 3.44, 7:22-4.40 through 4.44, 7:22-6.40 through 6.44 and 7:22A-1.8 through 1.13.

7:22-9.5 (Reserved)

7:22-9.6 Notice of SED utilization opportunities

(a) All project sponsors, at least 30 days prior to public advertisement for bids, shall notify the agencies specified in N.J.A.C. 7:22-9.13(a)8, of the availability of opportunities for SEDs to provide

services, to bid on unrestricted contracts or subcontracts, or to provide any other necessary purchase or procurement. The notice shall include a description of the type and scope of the services involved.

(b) All notices shall include a statement to the effect that the project or contract is funded in part by New Jersey wastewater treatment financing programs and the successful bidder must comply with all the provisions of N.J.A.C. 7:22-9.1 et seq. for the participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals.

7:22-9.7 Advertisements for SED utilization

(a) All advertisements for bids shall include a statement to the effect that the project or contract is funded in part by Jew Jersey environmental infrastructure financing programs and the successful bidder must comply with the provisions of N.J.A.C. 7:22-9 for the participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals.

(b) The advertisement for bids shall indicate that:

1. Awards will be made only to socially and economically disadvantaged business concerns that are certified by the New Jersey Commerce, Economic Growth and Tourism Commission, the New Jersey Department of Transportation, the Port Authority of New York and New Jersey, New Jersey Transit or other agencies deemed appropriate by the Office as eligible minority businesses or female businesses; or

2. The invitation to bid is on an unrestricted basis whereby the successful bidder must fulfill the SED utilization requirements. The agencies specified in N.J.A.C. 7:22-9.13(a)8 will have a list of eligible SED firms and shall, upon request, provide them to the project sponsor. The project sponsor shall, during the advertisement phase, provide copies of the list to all contractors on unrestricted contracts.

(c) The advertisement for bids shall be in such newspaper or newspapers and other periodicals identified by the agencies specified in N.J.A.C. 7:22-9.13 as will best give notice thereof to appropriate bidders and shall be sufficiently in advance of the purchase or contract to promote competitive bidding. In no case shall the advertisement for bids be published less than 30 days prior to the date fixed for receiving bids on the purchase or contract.

(d) In the case of a set aside contract, the newspaper or newspapers in which the advertisement for bids appears shall be selected by the contracting agency in consultation with the Office.

(e) If there are no responses to the bid solicitation from SEDs or if the successful bidder's proposal does not meet the SED utilization requirements, the successful bidder shall advertise and continue the search for SED participants for a minimum of 30 days after the contract is awarded. The contract shall include a provision to this effect.

7:22-9.8 (Reserved)

7:22-9.9 (Reserved)

7:22-9.10 Lowest bid resulting in payment of unreasonable price

(a) If the contracting agency determines that the acceptance of the lowest responsible bid will result either in the payment of an unreasonable price or in a contract otherwise unacceptable pursuant to the statutes and rules governing public contracts, the contracting agency shall reject all bids.

(b) Bidders and the office shall be notified of the rejection of all bids, the reasons for the rejection, and the contracting agency's intent to solicit bids for a second time.

(c) If the contracting agency determines a second time that the acceptance of the lowest responsible bid will result either in the payment of an unreasonable price or in a contract otherwise unacceptable pursuant to the statutes and rules governing public contracts, the contracting agency shall reject all bids and notify the Office and, after receipt of the Office's approval, shall amend the project plan accordingly.

(d) Bidders shall be notified of the cancellation, the reasons for the cancellation and the contracting agency's intent to resolicit bids on an unrestricted basis. SEDs may participate in the bidding on an unrestricted basis.

7:22-9.11 Project compliance officer

(a) Each project sponsor shall designate an officer or employee to serve as its project compliance officer.

(b) The project compliance officer shall be responsible for coordinating SED utilization efforts on the project and for monitoring and enforcing compliance with the affirmative action and SED requirements of the applicable program rules.

(c) SED utilization requirements shall be an agenda item at all contract award meetings and, wherever applicable, at preconstruction conference meetings regardless of whether a loan or grant agreement has been executed or not. Each project sponsor shall be responsible for notifying the Office of the time and place of such meetings.

(d) The project compliance officer shall attend all monthly construction progress meetings.

7:22-9.12 Reports

(a) The contracting agency shall submit its planning and design SED utilization report to the Office at the time of filing of its grant/loan application.

(b) Each project compliance officer shall submit the contracting agency's monthly progress reports to the Office. Once all SED contractors have been obtained, submittal of this report will no longer be required.

(c) Each project compliance officer shall submit a periodic report on behalf of the project sponsor to the Office according to a schedule announced by the Office. At a minimum, this construction report shall be submitted quarterly; that is, January, April, July and October. Where appropriate, the Office may approve a variation in the frequency of reporting requirements specified in (b) through (d) of this section. This report shall include the following information:

1. The value of each contract and subcontract awarded to SEDs and the total dollar value and number of contracts and subcontracts awarded to SEDs;

2. The percentage of SED utilization in comparison to the cost of each contract, as well as the total percentage of SED utilization (including set aside contracts) in comparison to overall project costs;

3. The types and sizes of the participating SEDs and the nature of goods and services being provided; and

4. The efforts made to publicize and promote the project sponsor's SED utilization plan.

(d) Contractors shall submit a quarterly construction report to the project sponsor and to the Office. The project compliance officer may be contacted for assistance if needed.

(e) The report forms required by (a) through (d) above shall be obtained from the Office.

(f) The project compliance officer shall submit reports or information in addition to what is required by (a) through (c) above when requested to do so by the Office.

(g) Failure to comply with the reporting requirements of (a) through (d) and (f) above may subject the project sponsor to the remedies for noncompliance with State and Trust loan or grant conditions specified in the applicable program rules.

7:22-9.13 Assessment of compliance

(a) Where the Office determines that a project sponsor has failed or is failing to meet the 10 percent SED utilization requirement, the project sponsor shall, upon the written request of the Office, submit the following:

1. Advertisements;

2. Signed contracts and subcontracts;

3. Documentation of solicitations of bids from SEDs;

4. Copies of Requests for Proposals;

5. Records of telephone quotations;

6. (Reserved);

7. Adequate and timely notice for encouraging SED participation; and

8. Proof that the assistance of State Agencies was solicited, including:

Office of Equal Opportunity and Public Contract Assistance
New Jersey Department of Environmental Protection
PO Box 402
Trenton, New Jersey 08625-0402

Division for the Development of Small Businesses and Women Businesses and Minority Businesses
New Jersey Commerce and Economic Growth Commission
PO Box 835
1 West State Street
Trenton, New Jersey 08625-0835

(b) Where the project sponsor determines that a contractor has failed or is failing to meet the 10 percent SED utilization requirement, the contractor shall, upon the written request of the project sponsor, submit the documents specified in (a) above.

(c) The Office shall summarize in writing its evaluation of the reason given for noncompliance and the efforts made by the project sponsor or contractor to comply with its plan for achieving the 10 percent SED utilization requirement. The Office shall take into consideration good faith efforts made by the project sponsor or contractor to meet the goal to achieve the ten percent SED utilization requirement. These findings shall be submitted to the Department and, in the case of a Trust loan, to the Trust who, in conjunction with the Office, shall determine the nature and extent of the project sponsor's or contractor's noncompliance.

7:22-9.14 Penalties

Whenever a project sponsor or a contractor has failed to comply with the requirements of this subchapter, including the 10 percent requirement for SED utilization, the Department, or the Department and the Trust, in the case of a Trust loan recipient, may withhold all of the loan or grant money, or a portion thereof, and may take any of the other actions or combinations thereof specified in N.J.A.C. 7:22-3.40 through 3.44, 7:22-4.40 through 4.44, 7:22-6.40 through 6.44 and 7:22A-1.8 through 1.13 which are remedies for noncompliance with any of the conditions of a loan or grant.

7:22-9.15 Administrative hearings

(a) The Department and, in the case of a Trust loan, the Trust, shall make a determination regarding all disputes arising under this subchapter. The project sponsor shall specifically detail in writing the basis for its dispute. The Department and/or the Trust shall produce a decision in writing and mail or otherwise furnish a copy thereof to the project sponsor.

(b) A project sponsor may request an administrative hearing within 20 days of receipt of a decision by the Department and/or the Trust. The request for a hearing shall be sent to the Office of Legal Affairs, ATTENTION: Adjudicatory Hearing Requests, Department of Environmental Protection, PO Box 402, Trenton, New Jersey 08625-0402. The request for an administrative hearing shall specify in detail the basis for the appeal. Administrative hearings shall be conducted in accordance with the requirements of the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq. and the Uniform Administrative Procedure Rules, N.J.A.C. 1:1.

(c) Following receipt of a request for a hearing pursuant to (b) above, the Department and/or the Trust may attempt to settle the dispute by conducting such proceedings, meetings and conferences as deemed appropriate.

7:22-9.16 Severability

If any of the provisions of this subchapter are found to be invalid, the remainder of the provisions of this subchapter shall not be affected thereby.

OFFICE OF EQUAL OPPORTUNITY
AND
PUBLIC CONTRACT ASSISTANCE

MUNICIPAL FINANCE
AND
CONSTRUCTION ELEMENT

SED PARTICIPATION

BUILDING PHASE

QUARTERLY REPORTING FORM

FOR

CONTRACTING AGENCIES & CONTRACTORS

(OEO-002)

New Jersey Department of Environmental Protection

REPORTING REQUIREMENTS ON SOCIALLY AND ECONOMICALLY DISADVANTAGED (SED) BUSINESS UTILIZATION

These instructions apply to reporting on the utilization of Socially and Economically Disadvantaged Businesses (MBEs/WBEs/SEDs) under the New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Financing Programs. They are intended to provide guidance to Project Sponsors and Contractors in filling out the Building Phase (SED) Utilization Form. The reporting requirements apply to all Contracting Agencies and Contractors pursuing New Jersey Financing Assistance through programs administered by the New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Trust pursuant to N.J.A.C. 7:22-3.; N.J.A.C. 7:22-4.; N.J.A.C. 7:22-6; N.J.A.C. 7:22A-6; N.J.A.C. 7:22-7.

Each Project Sponsor and Contractor must submit this building SED Report (Form OEO-002) quarterly on MBE/WBE utilization for each contract for which a Project Sponsor or its Contractor(s) awards a subagreement. The form must be submitted to the New Jersey Department of Environmental Protection (NJDEP), Office of Equal Opportunity, Public Contract Assistance within 15 days following the close of each fiscal year quarter (i.e., January 15, April 15, July 15, and October 15).

INSTRUCTIONS FOR FILLING OUT SED UTILIZATION REPORT

1. Read instructions carefully before completing form, and refer to N.J.A.C. 7:22-9.1 et seq. for further guidance.

2a. The name and address of Project Sponsor participating in the grant/loan programs for environmental infrastructure facilities.

2b. Name of the Project Compliance Officer responsible for submitting periodic reports.

3. Name and address of party contracting directly with the Project Sponsor.

4. Self-explanatory.

5a. The grant/loan project number for the agreement between the State of New Jersey and the Project Sponsor.

5b. The grant/loan project number for the contract between the Project Sponsor and its contractor(s).

6. Include brief description of project.

7. Self-explanatory.

8a. The county in which the Project Sponsor is located.

8b. The municipality in which the Project Sponsor is located.

9. The date of the agreement between the State of New Jersey and the Project Sponsor.

10a. The date of agreement between the Project Sponsor and the contractor.

10b. Self-explanatory.

11. Indicate MBE and WBE goals based upon project plan for SED utilization developed in consultation with the Office. These goals may vary depending upon local law. Where a Project Sponsor has a SED participation goal which exceeds ten percent, the Project Sponsor=s goal shall take precedence.

12. Enter the name, address and telephone number of each SED participating in the building phase as a subcontractor under agreement with the construction management firm or the Project Sponsor. Check applicable MBE or WBE status of each listed SED. Explain type of service rendered and list the total dollar amount of the subcontract. Each entry must be accompanied by a copy of the signed subcontract.

Restricted - Bids may be solicited on a restricted basis by setting aside a contract for building, materials and equipment, or services which is designated as a contract for which bids are invited and accepted only from SEDs.
Unrestricted - Bids may be solicited on an unrestricted basis and not designated for a set-aside contract, but the contract document shall include a statement to the effect that the successful bidder must fulfill the SED utilization requirements.

13. See instructions for Item 12. This section is designated for SEDs participating in the building phase of a project as a subcontractor under agreement with building contractor(s).

14. Person signing must be the designated Project Compliance Officer of the Project Sponsor. The contractor(s) or the authorized presentative of the contractor(s).

15. Additional comments or explanations. Refer to the specific item number on the form, if applicable.

OEO-002

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
NEW JERSEY MUNICIPAL FINANCE & CONSTRUCTION ELEMENT
OFFICE OF EQUAL OPPORTUNITY & PUBLIC CONTRACT ASSISTANCE

CONSTRUCTION REPORT

SOCIALLY AND ECONOMICALLY DISADVANTAGED (SED) BUSINESS UTILIZATION

1. ***Read Instructions Before Completing Form***.

2a. Project Sponsor

Name
_____

Address
_____

_____
___

2b. Project Compliance Officer _____

3. Contractor

Name
_____

Address
_____

_____
___

4. Financing Program *(check applicable program(s))*

_____a. Wastewater Treatment Fund _____b. Wastewater Treatment Trust _____c. Pinelands Infrastructure Trust

_____d. Stormwater Management _____e. Water Supply

5a. Project Number _____ 5b. Contract Number
_____

6. Project
Name_____

7. Contract Amount $_____

8a. County _____ 8b. Municipality
_____

9. Date of Grant/Loan Agreement _____

10a. Date of Contract Award _____ 10b. Duration of Contract: Mo. _____ Days _____

11. STATE GOAL OR OTHER STANDARDS (IF ANY)

Contracting Agency=s Requirement

	DOLLAR AMOUNT	**PERCENTAGE OF CONTRACT AMOUNT**
MBE	$ _____	_____ %
WBE	$ _____	_____ %
TOTAL SED	$ _____	_____ %

12. A/E and Other Professional Service Subcontracts Awarded During the Building Phase

Name, Address and Telephone No.	MBE/ WBE	Type of Service Rendered	Dollar Amount	Subcontract Number	Subcontract Award	Date of Subcontract (R/U)	Type of Award*
1.							
Number of Full-time Employees							
2.							
Number of Full-time Employees							
3.							
Number of Full-time Employees							
4.							
Number of Full-time Employees							
5.							
Number of Full-time Employees							
6.							
Number of Full-time Employees							

**** Restricted/Unrestricted***

13. Other Subcontract Awards Made Under the Building Phase

Name, Address and Telephone No.	MBE/ WBE	Type of Service Rendered	Dollar Amount	Subcontract Number	Subcontract Award	Date of Subcontract (R/U)	Type of Award*
1._____ _____ _____ _____	_____	_____	_____	_____	_____	_____	_____
Number of Full-time Employees _____							
2._____ _____ _____ _____	_____	_____	_____	_____	_____	_____	_____
Number of Full-time Employees _____							
3._____ _____ _____ _____	_____	_____	_____	_____	_____	_____	_____
Number of Full-time Employees _____							
4._____ _____ _____ _____	_____	_____	_____	_____	_____	_____	_____
Number of Full-time Employees _____							
5._____ _____ _____ _____	_____	_____	_____	_____	_____	_____	_____
Number of Full-time Employees _____							
6._____ _____ _____ _____	_____	_____	_____	_____	_____	_____	_____
Number of Full-time Employees _____							

**** Restricted/Unrestricted***

14. _____ _____

(Signature of Project Compliance Officer) *(Signature of Contractor)*

_____ _____

(Title) *(Title)*

_____ _____

(Date) *(Date)*

15. Space Provided for Additional Comments or Explanations

OFFICE OF EQUAL OPPORTUNITY
AND
PUBLIC CONTRACT ASSISTANCE

MUNICIPAL FINANCE
AND
CONSTRUCTION ELEMENT

SED PARTICIPATION

MONTHLY PROGRESS REPORT

(OEO-003)

New Jersey Department of Environmental Protection

OEO-003

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
SED UTILIZATION IN ENVIRONMENTAL INFRASTRUCTURE FINANCING PROGRAM

MONTHLY PROGRESS REPORT

Contractor_____

Project Number_____

Project Name_____

Contract Amount_____

Report Month/Year_____

The following information is required in order to assist the Project Compliance Officer and the New Jersey Department of Environmental Protection in monitoring the SED (small business enterprises owned and controlled by socially and economically disadvantaged individuals) Utilization progress and activity in the Environmental Infrastructure Financing Program. Each contractor shall respond to each of the listed items. Whenever evidence of completion of each item is available, copies of itemized documents are to be submitted to the Project Compliance Officer.

Over the past month has any action on any item taken place? Please explain each.

1.	Copies of Solicitation to SED=s	_____Yes	_____No
2.	Advertisement of bidding or procurement opportunities	_____Yes	_____No
3.	Evidence of negotiation with SEDs	_____Yes	_____No
4.	Copies of telephone quotes/negotiations	_____Yes	_____No
5.	Copies of signed subagreements	_____Yes	_____No
6.	Have any subcontracts been awarded in the past month	_____Yes	_____No

Please provide an explanation for Questions 1 through 6.

_____

_____

_____

_____

_____ _____

Signature of Contractor *Signature of Project Compliance Officer*

_____ _____

Date *Date*

APPENDIX E

WAGE RATE REQUIREMENTS

Attachment 2

Wage Rate Requirements under The Consolidated and Further Continuing Appropriations Act, 2013 (P.l. 113-6)

Preamble

With respect to the Clean Water and Safe Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State.

Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under **Roman Numeral I**, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in **Section 3(ii)(A),** below and for compliance as described in **Section 1-5**.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in **Roman Numeral II**, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in **Section ll-3(ii)(A),** below and for compliance as described in **Section 11-5**.

I. Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.l.113-6) For Subrecipients That Are Governmental Entities:

The following terms .and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Lorraine Fleury at fleury.lorraine@epa.gov or at 215-814-2341 of EPA, Region Ill Grants and Audit Management Branch for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's web site at http://www.dol.gov/whd/

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the

subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in§ 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act {29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in§ 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request

for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advice the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(l)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding.

The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section l(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(l)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section l(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(l) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or

the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under§ 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under§ 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State

Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(**5) Compliance with Copeland Act requirements**.

The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.S(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment.

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act.

These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the :same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(l) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item *3,* above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions *made,* and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 {SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim cred it for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item S(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at http:ljwww.dol.gov/contacts/whd/america2.htm.

APPENDIX F

LABOR STANDARD PROVISIONS

Title 29 —Labor

Subtitle A —Office of the Secretary of Labor

Part 5 —Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction (Also Labor Standards Provisions Applicable to Nonconstruction Contracts Subject to the Contract Work Hours and Safety Standards Act)

Subpart A —Davis-Bacon and Related Acts Provisions and Procedures

Source: 48 FR 19540, Apr. 29, 1983, unless otherwise noted.

Authority: 5 U.S.C. 301; Reorganization Plan No. 14 of 1950, 5 U.S.C. appendix; 28 U.S.C. 2461 note; 40 U.S.C. 3141 *et seq.;* 40 U.S.C. 3145; 40 U.S.C. 3148; 40 U.S.C. 3701 *et seq.;* Secretary's Order No. 01–2014, 79 FR 77527; and the laws referenced by § 5.1(a).

Source: 48 FR 19541, Apr. 29, 1983, unless otherwise noted.

Editorial Note: Nomenclature changes to subpart A of part 5 appear at 61 FR 19984, May 3, 1996.

§ 5.5 Contract provisions and related matters.

Link to an amendment published at 88 FR 57734, Aug. 23, 2023.

(a) ***Required contract clauses.*** The Agency head will cause or require the contracting officer to require the contracting officer to insert in full, or (for contracts covered by the Federal Acquisition Regulation (48 CFR chapter 1)) by reference, in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the laws referenced by § 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) ***Minimum wages*** —

(i) ***Wage rates and fringe benefits.*** All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of this section, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph (a)(1)(v) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph (a)(4) of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (a)(1)(iii) of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) ***Frequently recurring classifications.***

(A) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph (a)(1)(iii) of this section, provided that:

(*1*) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(*2*) The classification is used in the area by the construction industry; and

(*3*) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(B) The Administrator will establish wage rates for such classifications in accordance with paragraph (a)(1)(iii)(A)(*3*) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

(iii) ***Conformance.***

(A) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is used in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(C) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(D) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov,* refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(E) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs (a)(1)(iii)(C) and (D) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph (a)(1)(iii)(C) or (D) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iv) ***Fringe benefits not expressed as an hourly rate.*** Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(v) ***Unfunded plans.*** If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(vi) ***Interest.*** In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

(2) ***Withholding*** —

(i) ***Withholding requirements.*** The [write in name of Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in paragraph (a) of this

section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work (or otherwise working in construction or development of the project under a development statute) all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph (a)(3)(iv) of this section, the [Agency] may on its own initiative and after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

(3) ***Records and certified payrolls*** —

(i) ***Basic record requirements*** —

(A) ***Length of record retention.*** All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(B) ***Information required.*** Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(C) ***Additional records relating to fringe benefits.*** Whenever the Secretary of Labor has found under paragraph (a)(1)(v) of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(D) ***Additional records relating to apprenticeship.*** Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

(ii) ***Certified payroll requirements*** —

(A) ***Frequency and method of submission.*** The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the [write in name of appropriate Federal agency] if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the certified payrolls to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency]. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(B) ***Information required.*** The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph (a)(3)(i)(B) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the sponsoring government agency (or the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records).

(C) ***Statement of Compliance.*** Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(*1*) That the certified payroll for the payroll period contains the information required to be provided under paragraph (a)(3)(ii) of this section, the appropriate information and basic records are being maintained under paragraph (a)(3)(i) of this section, and such information and records are correct and complete;

(*2*) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(D) ***Use of Optional Form WH–347.*** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(C) of this section.

(E) ***Signature.*** The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(F) ***Falsification.*** The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(G) ***Length of certified payroll retention.*** The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iii) ***Contracts, subcontracts, and related documents.*** The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

(iv) ***Required disclosures and access*** —

(A) ***Required record disclosures and access to workers.*** The contractor or subcontractor must make the records required under paragraphs (a)(3)(i) through (iii) of this section, and any other documents that the [write the name of the agency] or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or

transcription by authorized representatives of the [write the name of the agency] or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(B) ***Sanctions for non-compliance with records and worker access requirements.*** If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(C) ***Required information disclosures.*** Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the [write in name of appropriate Federal agency] if the agency is a party to the contract, or to the Wage and Hour Division of the Department of Labor. If the Federal agency is not such a party to the contract, the contractor, subcontractor, or both, must, upon request, provide the full Social Security number and last known address, telephone number, and email address of each covered worker to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the [write in name of agency], the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

(4) ***Apprentices and equal employment opportunity*** —

(i) ***Apprentices*** —

(A) ***Rate of pay.*** Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an

apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(B) ***Fringe benefits.*** Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(C) ***Apprenticeship ratio.*** The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph (a)(4)(i)(D) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(4)(i)(A) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(D) ***Reciprocity of ratios and wage rates.*** Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

(ii) ***Equal employment opportunity.*** The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses contained in paragraphs (a)(1) through (11) of this section, along with the applicable wage determination(s) and such other clauses or contract modifications as the [write in the name of the Federal agency] may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate.

(7) ***Contract termination: debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

(iii) The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

(11) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

(iv) Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

(b) ***Contract Work Hours and Safety Standards Act (CWHSSA).*** The Agency Head must cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1) through (5) of this section in full, or (for contracts covered by the Federal Acquisition Regulation) by reference, in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses must be inserted in addition to the clauses required by paragraph (a) of this section or 29 CFR 4.6. As used in this paragraph (b), the terms “laborers and mechanics” include watchpersons and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the conract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in

excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) ***Violation; liability for unpaid wages; liquidated damages.*** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $32 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1).

(3) ***Withholding for unpaid wages and liquidated damages*** —

(i) ***Withholding process.*** The [write in the name of the Federal agency or the recipient of Federal assistance] may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this paragraph (b) on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

(ii) ***Priority to withheld funds.*** The Department has priority to funds withheld or to be withheld in accordance with paragraph (a)(2)(i) or (b)(3)(i) of this section, or both, over claims to those funds by:

(A) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(B) A contracting agency for its reprocurement costs;

(C) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(D) A contractor's assignee(s);

(E) A contractor's successor(s); or

(F) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

(4) ***Subcontracts.*** The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs (b)(1) through (5) of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by

any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (5). In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

(5) ***Anti-retaliation.*** It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

(i) Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

(ii) Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

(iii) Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

(iv) Informing any other person about their rights under CWHSSA or this part.

(c) ***CWHSSA required records clause.*** In addition to the clauses contained in paragraph (b) of this section, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other laws referenced by § 5.1, the Agency Head must cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor must maintain regular payrolls and other basic records during the course of the work and must preserve them for a period of 3 years after all the work on the prime contract is completed for all laborers and mechanics, including guards and watchpersons, working on the contract. Such records must contain the name; last known address, telephone number, and email address; and social security number of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid; daily and weekly number of hours actually worked; deductions made; and actual wages paid. Further, the Agency Head must cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph must be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview workers during working hours on the job.

(d) ***Incorporation of contract clauses and wage determinations by reference.*** Although agencies are required to insert the contract clauses set forth in this section, along with appropriate wage determinations, in full into covered contracts, and contractors and subcontractors are required to insert them in any lower-tier subcontracts, the incorporation by reference of the required contract clauses and appropriate wage determinations will be given the same force and effect as if they were inserted in full text.

(e) ***Incorporation by operation of law.*** The contract clauses set forth in this section (or their equivalent under the Federal Acquisition Regulation), along with the correct wage determinations, will be considered to be a part of every prime contract required by the applicable statutes referenced by § 5.1 to include such clauses, and will be effective by operation of law, whether or not they are included or incorporated by reference into such contract, unless the Administrator grants a variance, tolerance, or exemption from the

application of this paragraph. Where the clauses and applicable wage determinations are effective by operation of law under this paragraph, the prime contractor must be compensated for any resulting increase in wages in accordance with applicable law.

(The information collection, recordkeeping, and reporting requirements contained in the following paragraphs of this section were approved by the Office of Management and Budget:

Paragraph	OMB Control No.
(a)(1)(ii)(B)	1235–0023
(a)(1)(ii)(C)	1235–0023
(a)(1)(iv)	1235–0023
(a)(3)(i)	1235–0023
(a)(3)(ii)(A)	1235–0023
	1235–0008
(c)	1235–0023

[48 FR 19540, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 55 FR 50150, Dec. 4, 1990; 57 FR 28776, June 26, 1992; 58 FR 58955, Nov. 5, 1993; 61 FR 40716, Aug. 5, 1996; 65 FR 69693, Nov. 20, 2000; 73 FR 77511, Dec. 19, 2008; 81 FR 43450, July 1, 2016; 82 FR 2225, 2226, Jan. 9, 2017; 83 FR 12, Jan 2, 2018; 84 FR 218, Jan. 23, 2019; 87 FR 2334, Jan. 14, 2022; 88 FR 2215, Jan. 13, 2023; 88 FR 57734, Aug. 23, 2023; 89 FR 1815, Jan. 11, 2024]

APPENDIX G

IMPLEMENTATION OF IRON AND STEEL PROVISIONS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: For Andrew D. Sawyers, Director
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term ‘‘iron and steel products’’ means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the ‘‘Administrator’’) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with "split" funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger

project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

Lined or unlined pipes or fittings;
Manhole Covers;
Municipal Castings (defined in more detail below);
Hydrants;
Tanks;
Flanges;
Pipe clamps and restraints;
Valves;
Structural steel (defined in more detail below);
Reinforced precast concrete; and
Construction materials (defined in more detail below).

12) What does the term 'primarily iron or steel' mean?

'Primarily iron or steel' places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does 'produced in the United States' mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of 'municipal castings'?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is 'structural steel'?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a 'construction material' for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a 'construction material' for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: http://www.epa.gov/oig/hotline.htm.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm

2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests • Does the waiver request include the following information? — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products				
— Relevant excerpts from the bid documents used by the contractors to complete the comparison				
— A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market				
• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials				
• Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?				
• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)				
• Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials				
• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 3: Example Loan Agreement Language

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel Requirement") unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

Appendix 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of _____ ("Purchaser") and the _____ (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

APPENDIX H

N.J.A.C. TITLE 7, CHAPTER 14
WATER POLLUTION CONTROL ACT

NOTE: REQUIREMENTS UNDER THIS SUBCHAPTER TAKES PRECEDENT OVER ANY CONTRADICTORY LANGUAGE WITHIN THESE SPECIFICATIONS

§ 7:14-2.1 Construction procedures

The Department shall require and adhere to the procedures identified in this subchapter. Actions or procedures by owners, permittees, consultants, contractors, or other persons affected by this subchapter which are not in accordance with this subchapter shall not be acceptable to the Department. Where applicable, the Department may grant a waiver from any requirement of this subchapter upon presentation of written justification by the owner, permittee, consultant or contractor.

HISTORY:

Amended by R.1999 d.163, effective May 17, 1999.

See: 31 New Jersey Register 508(b), 31 New Jersey Register 1314(b).

Substituted references to the Department for references to the Division and substituted references to this subchapter for references to this chapter throughout.

§ 7:14-2.2 Record drawings; collector sewers, interceptor sewers and force mains

(a) The owner shall be responsible for the preparation of all record drawings required for sewer lines. This responsibility may be delegated to the owner's representative with adequate compensation for this service.

(b) This responsibility shall not be delegated or transferred to the contractor. The contractor shall assist the owner/engineer, by providing record information, when requested, during the progress of the work.

§ 7:14-2.3 Permits

(a) Federal, State, county and municipal permits required as a result of the construction activity within the delineated site shall be obtained by the owner and associated fees shall be paid by the owner. In addition, permits required for construction activities on railroad properties shall be obtained by the owner.

(b) Exceptions to this section shall be a permit to use explosives for rock excavation and such other permits which by law are required to be obtained by the contractor.

(c) The owner shall make every reasonable effort to identify permits and fees and costs required as a result of the construction activity in effect 60 days prior to the receipt of construction bids. This responsibility may be delegated to the owner's engineer with adequate compensation for this service. The engineer shall be held harmless from any penalty or action resulting from the failure to obtain a permit where every reasonable effort has been made by the engineer to obtain such permits. Conditions made a part of any permit shall be imposed upon the contractor as described in the contract or bid documents. Additional costs associated with a permit resulting from the construction activity which is beyond that stipulated in the contract shall be the responsibility of the contractor.

(d) Whenever necessary or appropriate the contractor shall assist the owner in the acquisition of permits.

(e) The Department may intercede and assist in the resolution of any problems resulting from the acquisition of any permits.

§ 7:14-2.4 Easements/rights-of-way

An interruption of construction or an extension of contract time may be a basis for a claim by a contractor for additional cost when such interruption or extension is caused by the owner's inability to obtain an easement/right-of-way. Claims shall include any reasonable cost incurred by the contractor and shall be reviewed and approved by the owner prior to submission to the Department. The Department may approve all, any portion, or deny the cost for eligibility for projects funded under the Grant Program.

§ 7:14-2.5 Field layout (baseline and monuments)

The owner shall be responsible to establish and confirm field controls prior to start of construction. The contractor shall not be liable to check the accuracy of field controls (baseline and monuments) for sewer pipe installation. However, the contractor's layout must be based on a minimum of two field control points. Whenever the contractor detects an error in the field controls during pipe installation, the contractor shall immediately notify the owner and the owner's engineer of such error with sufficient documentation. The contractor shall be held responsible for all corrective measures and associated costs for failure to notify the owner of such error.

§ 7:14-2.6 Engineer design activities: plan scale and plan updating

(a) On occasion, projects do not go to construction within a reasonable time after the bid advertisement. During this period, utilities may be relocated or installed, as well as other changes which can take place that are unknown to the contractor. Because of this, problems can take place during construction and result in numerous change orders and increases in the cost of the project.

(b) The horizontal scale for construction plans for sewerage facilities shall not be less than one inch equals 100 feet. A larger horizontal scale shall be used where appropriate to show sufficient detail to construct the project. The vertical scale for construction plans for sewerage facilities shall be not less than one inch equals 10 feet. Based upon the best information available, the location of underground utilities and support structures for overhead utilities shall be shown on the plans.

(c) Construction plans for sewerage facilities shall be updated whenever the bid advertisement date exceeds one year after approval by the responsible State or Federal regulatory agency. The engineer shall receive adequate compensation for updating plans and specifications. All such revisions shall be noted and dated on the plans prior to bid.

§ 7:14-2.7 Construction, overhead and profit factors for Extra Work compensation

(a) The contractor is entitled to all identifiable direct job costs associated with Extra Work excluding subcontractor's costs. For Extra Work not in excess of $ 10,000 the contractors may add up to 10 percent overhead factor to their identifiable direct job costs, but excluding the cost of any subcontracting, plus up to a 10 percent profit factor to their identifiable direct costs plus overhead amount.

(b) As general policy, these overhead and profit factors may be accepted by owners as reasonable in lieu of requiring the submission of additional supporting data. However, the owner must reserve its right to review any cost or profit element on a case-by-case basis, where the submission for overhead and profit is in excess of the 10 percent overhead and 10 percent profit indicated above.

(c) Cost increase in subcontracted work may be similarly handled and a prime contractor may add up to 10 percent to the total cost (including overhead and profit factors) incurred by the subcontractor. In such cases, the same reservations for rights shall apply.

(d) For Extra Work in the amount of $ 10,000 to $ 100,000, the above factors may be included initially for equitable adjustments but will be subject to negotiation, cost and pricing data, and owner review requirements. Federally funded projects will be governed by Federal regulations.

§ 7:14-2.8 Payments to contractors

(a) At least 20 days before each monthly progress payment falls due for approval (but not more often than once per month), the contractor will submit to the engineer a partial payment estimate filled out and signed by the contractor covering the work performed during the period covered by the partial payment estimate and supported by such data as the engineer may reasonably require. Where any specific item(s) in the partial payment estimate is in dispute, the engineer may delete those costs from the estimate and approve the acceptable portion of the payment request. Payment requested for stored materials and/or equipment shall be subject to the following conditions being met or satisfied:

1. The materials and/or equipment shall be received in a condition satisfactory for incorporation in the work.
2. The materials and/or equipment shall be stored in such manner that they will not be damaged due to weather, construction operations or any other cause.
3. An invoice from the supplier shall be furnished for each item on which payment is requested.
4. The contractor shall furnish written proof from the supplier of 90 percent payment for the materials and/or equipment no later than 30 days after receipt of payment for same from the owner. The owner shall have the right to deduct from the next payment estimate an amount equal to the payment for said material and/or equipment if reasonable and adequate proof is not submitted.

(b) The contractor warrants and guarantees that title to all work, materials, and equipment covered by an Application for Payment, whether incorporated in the project or not, will pass to the owner upon the receipt of such payment by the contractor free and clear of all lien, claims, security interests or encumbrances (except 10 percent retention which may be withheld from suppliers and subcontractors to guarantee completion and performance). The engineer will after receipt of each partial payment estimate either indicate in writing his approval of payment and present the partial payment estimate to the owner, or return the partial payment estimate to the contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the contractor may make the necessary corrections and resubmit the partial payment estimate. The owner shall review the partial payment estimate at its next regularly scheduled meeting and, if approved, payment shall be made available to the contractor within five days. The owner shall retain not more than two percent of the amount of each payment claimed. In accordance with EPA regulations, prime contractors are also required to make prompt payment to

subcontractors and suppliers for eligible construction, material, and equipment costs. Generally, payments of all valid subcontractor and supplier requests for payment should be satisfied prior to the next succeeding request for progress payment by the prime contractor.

(c) When the work is substantially complete (Operational or Beneficial Occupancy), the withheld amount shall be further reduced below two percent but not less than twice the current market value of the work yet to be completed. On completion and acceptance of a part of the work on which the price is stated separately in the Contract Documents, payment shall be made in full including retained percentages, less authorized deductions. The contractor or owner may request assistance and guidance from the Department on disputes regarding retainage.

(d) "Substantial completion" as used in the context of this section shall mean satisfactory completion of major portions of the contract work, including inspection and testing, so that the facility may be turned over to the owner for its intended use or occupancy. The engineer shall certify the date of substantial completion and that date shall establish the beginning date of the warranty/guarantee period unless a prior date has been established.

§ 7:14-2.9 Mobilization: unit price contracts for sewer construction

(a) Mobilization shall consist of the cost of initiating the contract. Payment for mobilization will be made at the lump sum price bid for this item in the proposal, which price shall include the cost of initiating the contract. The provisions for payment for the item mobilization supersede any provisions elsewhere in the specifications for including the costs of these initial services and facilities in the prices bid for the various items scheduled in the proposal. The lump sum price bid for mobilization shall be payable to the contractor whenever he shall have completed 10 percent of the work of the contract. For the purposes of this item, 10 percent of the work shall be considered completed when the total of payments earned, exclusive of the amount bid for this item, shown on the monthly certificates of the approximate quantities of work done, shall exceed 10 percent of the total price bid for the contract.

(b) The lump sum price bid for mobilization is limited to the following maximum amounts:

Original Contract Amount (including Mobilization)

From More Than	To and Including	Maximum Amount for Item of Mobilization
$ 0	$ 100,000	$ 3,000
100,000	500,000	15,000
500,000	1,000,000	30,000
1,000,000	2,000,000	60,000
2,000,000	3,000,000	90,000
3,000,000	4,000,000	120,000
4,000,000	5,000,000	125,000
5,000,000	6,000,000	150,000
6,000,000	7,000,000	175,000
7,000,000	10,000,000	200,000
10,000,000	--	2.5% of Amount Bid

§ 7:14-2.10 Bid items for sewer pipe installation

(a) This section establishes bid items which shall be included in unit price contracts for sewer pipe installation where applicable.

	Description	Unit of Measure
1.	Test Pits	Cubic Yard
2.	Stone Foundation (bedding)	Cubic Yard
3.	Select Material (below and above pipe grade)	Cubic Yard
4.	Rock Excavation (including removal and disposal of boulders)	Cubic Yard
5.	Wood Sheeting (install and remove where shown on plans)	Square Feet or 1000 Board Feet
6.	Wood Sheeting (left in place where shown on plans)	Square Feet or 1000 Board Feet
7.	Steel Sheeting (install and remove where shown on plans)	Square Feet or Tons
8.	Steel Sheeting (left in place where shown on plans)	Square Feet or Tons
9.	Permanent Pavement Gravel	Square Yard
10.	Pavement	
	i. Municipal:	
	(1) Temporary which shall be removed (where applicable)	Square Yard
	(2) Base	Square Yard
	(3) Top	Square Yard
	ii. County:	
	(1) Temporary which shall be removed (where applicable)	Square Yard
	(2) Base	Square Yard
	(3) Top	Square Yard
	iii. State:	
	(1) Temporary which shall be removed (where applicable)	Square Yard
	(2) Base	Square Yard
	(3) Top	Square Yard
11.	Testing	Linear Feet
12.	Concrete Cradle or Encasement (to be identified where applicable)	Cubic Yard

§ 7:14-2.11 Reasonable minimum unit prices

(a) This section establishes reasonable minimum unit prices for indeterminate items, where applicable, for sewer pipe installation. Indeterminate items are those items which may be anticipated and for which quantities cannot be determined.

(b) The reasonable minimum unit prices are to be established by the owner/engineer for the following items:

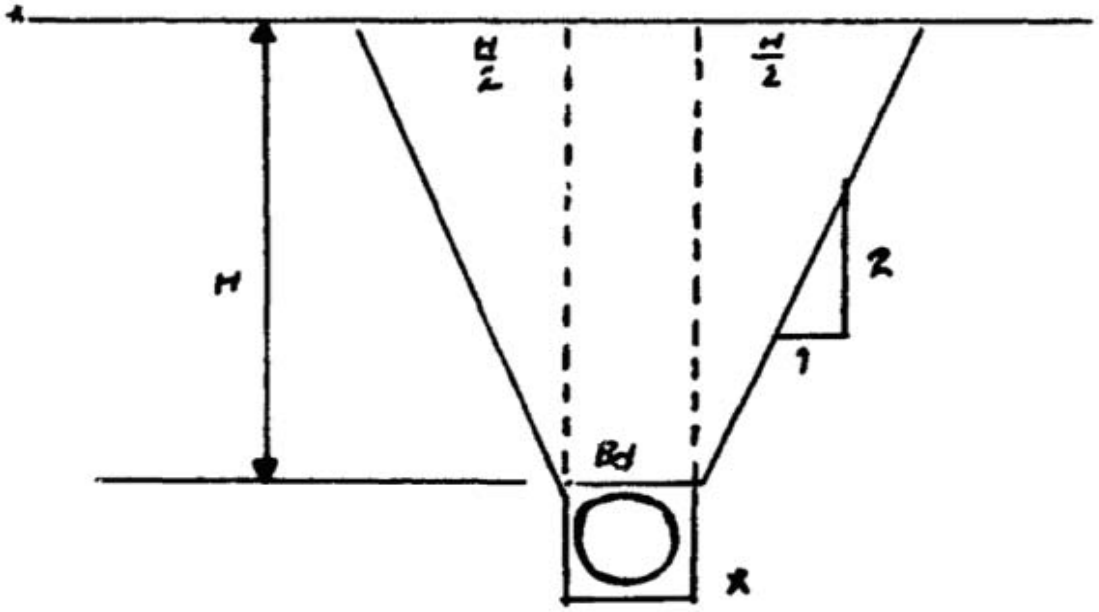
1. Stone Foundation;
2. Select Material;
3. Concrete Cradle or Encasement--Nonreinforced;
4. Concrete Cradle or Encasement--Reinforced;
5. Test Pits;
6. Rock Excavation;
7. Wood Sheeting (install and remove)--square feet or 1000 board feet;
8. Wood Sheeting (left in place)--square feet or 1000 board feet;
9. Steel Sheeting (install and remove)--square feet or tons;
10. Steel Sheeting (left in place)--square feet or tons.

§ 7:14-2.12 Payment widths, trench backfill and roadway paving for Federally funded sewer projects

(a) This section establishes eligible payment widths for select fill used for trench backfill and roadway pavement for federally funded sewer projects.

1. Select trench backfill will be eligible for grant funding when the excavated material is totally or partially unacceptable for reuse as trench backfill. When the unacceptable material must be replaced with approved select backfill in a trench with a depth of 10 feet or less from the top of the pipe, the eligible payment width shall be Bd as shown below. For trenches of a greater depth the maximum eligible payment width shall be Bd plus H for the depth of unsuitable material as measured at the time of excavation.

2. When trench width is less than Bd plus H, the actual width shall control the payment.

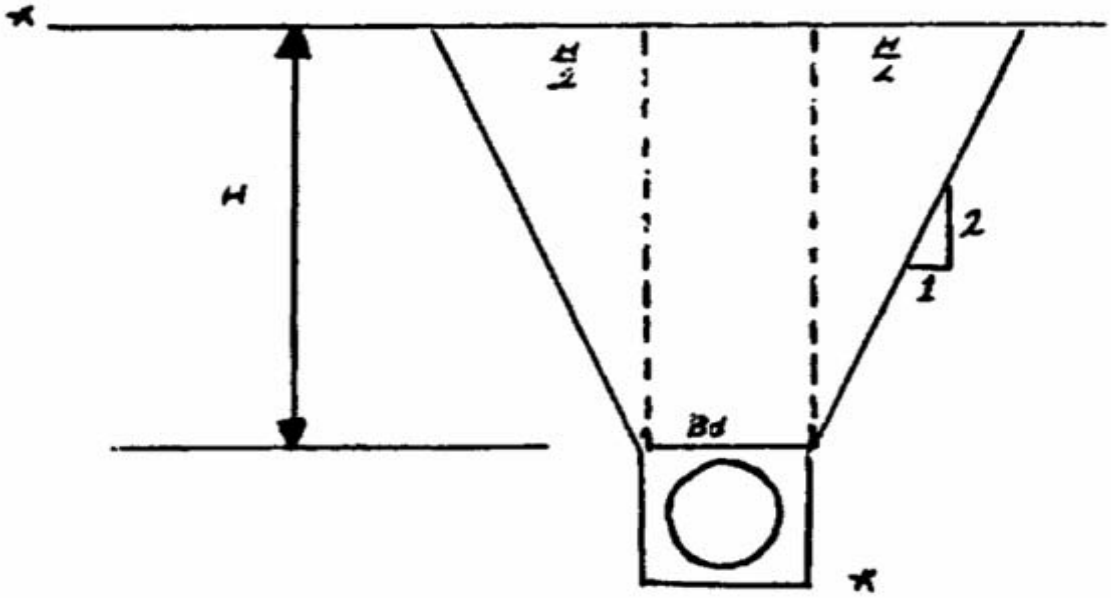


3. Bd equals Maximum trench width (measured at the top of the pipe) allowed by the engineer for the type and strength class of pipe being installed.

4. The owner/engineer must make every effort to minimize the use of select fill. Marginal backfill material (material which is not acceptable for use in the pipe envelope or as a subbase for roadways) will be limited to the midzone of the trench. The midzone is defined as that portion of the trench beginning two feet above the top of the pipe, after compaction of the pipe envelope, to a point two feet below the final road or easement elevation. The owner/engineer must make all final decisions concerning the above.

(b) Paving:

1. Maximum eligible payment width shall be the disturbed width plus two feet. In no case shall the maximum eligible payment width be greater than Bd plus H;



2. Maximum Eligible Pay Width equals Bd plus H;

   i. Pavement replacement shall, in all instances, be "like kind" replacement except where the replacement of the original thickness of roadway material will not yield a structurally stable surface over the disturbed trench area, or where the requirements of the responsible governmental jurisdiction specify roadway materials other than the original disturbed pavement. In these instances, the engineer should specify the minimum thickness necessary to obtain a structurally sound surface or to comply with established local, county or State road opening permit requirements. Such requirements shall be contained in the contract documents.

   ii. Roadways where the original total pavement thickness is less than two inches and the pavement cannot be boxed and maintained during construction, will be eligible for "like kind" replacement outside of the eligible trench pavement width.

   iii. Any deviation from the above should be submitted during the design phase (Step II) for approval if possible. In all instances, approvals must be obtained prior to soliciting bids.

   iv. Reducing the pavement thickness specified by the engineer and spreading it across a wider area of the street will not be approved unless extenuating circumstances justify the need to pave a wider area. These situations will be considered on a case by case basis and must be submitted as a Change Order and receive approval prior to implementing such a change.

(c) Application of this section is mandatory for all Federal Grants awarded to projects, pursuant to the provisions of the Federal Clean Water Act (33 U.S.C. §§ 1251 et seq.) as amended, before October 1, 1998. For all Federal Grants awarded after October 1, 1998, the allowable costs shall be determined in accordance with the applicable provisions of the Financial Assistance Programs for Environmental Infrastructure Facilities rules at 7:22-5, Determination of Allowable Costs: Fund and Trust.

HISTORY:

Amended by R.1999 d.163, effective May 17, 1999.

See: 31 New Jersey Register 508(b), 31 New Jersey Register 1314(b).

Rewrote (d).

§ 7:14-2.13 Excavation material unacceptable or conditionally acceptable for reuse as trench backfill

(a) The following trench excavation materials are unacceptable as trench backfill:

1. Any excavation materials that will cause damage to the piping systems;
2. Any excavation material that cannot be compacted or consolidated to yield the desired density as specified in the contract specifications;
3. Trees, stumps and foreign material.

(b) The following excavation materials are conditionally acceptable as trench backfill only if provided for in the contract specifications and the trench is located in a right-of-way, an easement, a roadway or an unimproved area:

1. Clay, organics and silt determined to be suitable in accordance with soil tests required by the owner/engineer.

2. Hard materials, such as blacktop, concrete, stone and rock.
   i. The hard materials shall only be placed in the midzone of the trench beginning two feet above the top of the pipe, after compaction of the pipe envelope, to a point two feet below the final road or ground surface.
   ii. Placement of the hard materials shall not create a potential hazard to the pipe or create voids that will cause adverse settlement.
   iii. The maximum overall size of any piece of hard material shall be 12 inches.

(c) The Department may require that all trench backfill material not conforming to this subsection and contract specifications be removed and spoiled to a spoil site approved by the Department in accordance with the requirements of 7:26-1, for solid or hazardous wastes.

HISTORY:

R.1984 d.339, effective August 6, 1984.

See: 16 New Jersey Register 1147(a), 16 New Jersey Register 2102(b).

§ 7:14-2.14 Construction equipment costs compensation for extra work

(a) The contractor is entitled to all identifiable direct job equipment costs associated with extra work. The compensable cost for construction equipment shall be based upon the most current costs established in "Rental Rates for Construction Equipment" and "Rental Rates for Older Construction Equipment" (Blue Book), Dataquest Incorporated, A.C. Nielsen Company, San Jose, CA, 1983.

(b) Overhead and profits factors allowed in 7:14-2.7, shall only be applied to the rates charged for rental equipment used by the contractor for extra work.

HISTORY:

R.1984 d.339, effective August 6, 1984.

See: 16 New Jersey Register 1147(a), 16 New Jersey Register 2102(b).

§ 7:14-2.15 Substantial and final completion of pipe projects; contractor's guarantees

(a) The contractor shall notify the owner/engineer in writing when the contract work is substantially complete as defined by 7:14-2.8(d). Within a reasonable time, the owner/engineer shall inspect the work.

(b) If the owner/engineer considers the work to be substantially complete, and before the Certificate of Substantial Completion is issued, the contractor shall:

1. Submit a construction schedule for the remaining work to be completed, and
2. Warrant and guarantee, for a period of one year or for a period as otherwise specified, from the date of Substantial Completion, that the completed work is free from defects due to faulty materials, equipment or workmanship. The Performance Bond shall remain in effect through the guarantee period.

(c) If the owner/engineer does not consider the work to be substantially complete, the engineer shall notify the contractor in writing, listing the items to be completed or corrected.

1. The contractor shall correct or complete items identified in writing within a reasonable time as specified in the contract documents, including repairs of any damage resulting from such defects to other work completed under the contract.
2. If the contractor fails to make such corrections within a reasonable time as specified in the contract documents, the owner may do so and charge the costs incurred, including direct and indirect costs, to the contractor.

(e) Before the Contractor has received notification of substantial completion, the owner/engineer may submit a request to the contractor to use a functional portion of the work if:

1. Such use does not significantly interfere with construction on any portion of remaining work to be completed, and
2. The conditions of such use shall be identified in the Certificate of Substantial Completion when issued by the owner/engineer.

(f) Final completion shall be that point at which the contract is completed, defective work corrected and clean up work accomplished. Unless a Certificate of Substantial Completion has been issued, the guarantee period shall begin upon certification of final completion by the engineer.

HISTORY:

R.1984 d.339, effective August 6, 1984.

See: 16 New Jersey Register 1147(a), 16 New Jersey Register 2102(b).

APPENDIX I

PROMPT PAYMENT CERTIFICATION

Prompt Payment Certification

I make this certification on behalf of myself as a representative of the contractor named below ("Contractor") and on behalf of the Contractor. I certify that for each application for payment submitted in connection with this project: (1) the work covered by that application for payment has been completed in accordance with the contract documents; (2) the payment requested is due; and (3) all amounts have been paid by the Contractor for work for which previous payments were issued. No application for payment will be submitted without Contractor having paid all subcontractors and suppliers their share of any funds received by Contractor pursuant to any previous application(s) for payment. I understand and acknowledge that this entire certification will be considered incorporated into every request for payment. I understand and acknowledge that if Contractor submits an application for payment without (1) having completed work in accordance with the contract documents, (2) payment requested being due, and/or (3) having paid all subcontractors and suppliers their share of any funds received by Contractor pursuant to any previous application(s) for payment, then Contractor has submitted a false claim and false certification, subjecting Contractor to liability, damages and penalties under the New Jersey False Claims Act, N.J.S.A. 2A:32C-1 et seq.

If there is some legitimate reason Contractor cannot timely pay a subcontractor or supplier, then Contractor must submit a signed certification or affidavit to the owner/government entity fully explaining the situation, when the situation arose, and when it will be resolved. A failure to submit such an explanatory certification waives any defenses Contractor may later seek to assert in connection with liability under the New Jersey False Claims Act, N.J.S.A. 2A:32C-1 et seq. or any other law, including N.J.A.C. 7:1D et seq.

I further understand and acknowledge that a false certification, whether express or implied, that (1) the work covered by an application for payment has been completed in accordance with the contract documents, (2) the payment requested is due, and/or (3) all amounts have been paid by the Contractor to subcontractors or suppliers for work for which previous payments were issued, is misleading with respect to the goods and services Contractor is providing.

I also understand and acknowledge that the requirements that (1) work has been completed in accordance with the contract documents, (2) the payment requested is due, and (3) all amounts have been paid by the Contractor for work for which previous payments were issued, are material to the State's decision to allocate State funding dollars for this contract, and also material to any local government entity's decision to retain and make payment to the contractor. I understand and acknowledge that if owner/government entity makes payment knowing of such violations, that does not demonstrate that the requirements are not material, and does not constitute a waiver of liability under the New Jersey False Claims Act, N.J.S.A. 2A:32C-1 et seq.

To the contrary, Contractor recognizes that owner/government entity may decide to continue to pay Contractor due to contractual and/or logistical requirements or considerations.

Additionally, I understand and acknowledge that a false certification, whether express or implied, that (1) the work covered by an application for payment has been completed in accordance with the contract documents, (2) the payment requested is due, and/or (3) all amounts have been paid by the Contractor for work for which previous payments were issued, constitutes legitimate grounds for debarment pursuant to N.J.A.C. 7:1D et seq.

_____ _____

(Signature) (Date)

_____

(Name and Title of Signer – Please Type)

APPENDIX J

BABA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WATER

November 3, 2022

MEMORANDUM

SUBJECT: Build America, Buy America Act Implementation Procedures for EPA Office of Water Federal Financial Assistance Programs

FROM: Radhika Fox
Assistant Administrator

TO: EPA Regional Water Division Directors, Regions I – X
EPA Office of Water Office Directors

OVERVIEW

The Biden-Harris Administration recognized the Nation's critical need for infrastructure investment, championing the Bipartisan Infrastructure Law (BIL), which Congress passed on November 15, 2021 (also known as the Infrastructure Investment and Jobs Act (IIJA)). The BIL will provide an unprecedented level of federal investment in water and wastewater infrastructure in communities across America.

In Title IX of the IIJA, Congress passed the Build America, Buy America (BABA) Act, which establishes strong and permanent domestic sourcing requirements across all Federal financial assistance programs for infrastructure. The U.S. Environmental Protection Agency (EPA) Office of Water is honored to help lead the implementation of these provisions and is proud of its near decade of successful implementation of the American Iron and Steel (AIS) provisions for its flagship water infrastructure programs.

This is a transformational opportunity to build a resilient supply chain and manufacturing base for critical products here in the United States that will spur investment in good-paying American manufacturing jobs and businesses. EPA's efforts to implement BABA will help cultivate the domestic manufacturing base for a wide range of products commonly used across the water sector but not currently made domestically. This will take time, and flexibility will be important to ensure that EPA can leverage critical water investments on time and on budget to protect public health and improve water quality.

IMPLEMENTATION

Recognizing the opportunity and need for BABA implementation guidance, the Made in America Office (MIAO) of the Office of Management and Budget (OMB) published Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure (OMB Guidance M-22-11) on April 18, 2022. The guidance provides government-wide implementation direction for all Federal financial assistance programs for infrastructure. Despite the extensive guidance developed by MIAO, EPA's Office of Water infrastructure investment programs have received many questions that were not addressed in OMB Guidance M-22-11 or that require further clarification for EPA water infrastructure programs. The following questions and answers serve to supplement OMB Guidance M-22-11 with implementation procedures specific to EPA's relevant water infrastructure programs.

Section 70914(a) of the IIJA states when a Buy America preference under BABA applies: "Not later than… [May 14, 2022], the head of each Federal agency shall ensure that none of the funds made available for a Federal financial assistance program for infrastructure…may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States." Therefore, Federal financial infrastructure investments obligated on or after May 14, 2022, must comply with the BABA requirements. Absent a waiver, all iron, steel, manufactured products, and construction materials permanently incorporated into an infrastructure project subject to the BABA requirements must be produced in the United States. For many of EPA's Office of Water infrastructure investment programs, the vast majority of products permanently incorporated into construction, maintenance, or repair projects must comply with the BABA requirements, with the exception of select construction materials (cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives), which are specifically excepted by the BABA statute.

EPA's Office of Water implements many infrastructure investment programs subject to BABA requirements, including the following:

- Alaska Native Villages and Rural Communities Water Grant Program (ANV) (and any associated Interagency Agreements with the Indian Health Service)
- Clean Water and Drinking Water State Revolving Fund Programs (CW and DWSRF)
- Clean Water and Drinking Water Grants to U.S. Territories and the District of Columbia
- Clean Water Indian and Drinking Water Tribal Infrastructure Grant Set-aside (and any associated Interagency Agreements with the Indian Health Service)
- Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA) Programs
- Congressionally Directed Spending/Community Project Funding (also known as Community Grants)
- Geographic Programs[1]
- Gulf Hypoxia Program
- National Estuaries Program (CWA Section 320)

[1] Geographic Programs include: Great Lakes Restoration Initiative, Chesapeake Bay, San Francisco Bay, Puget Sound, Long Island Sound, Gulf of Mexico, South Florida, Lake Champlain, Lake Pontchartrain, Southern New England Estuaries, Columbia River Basin, Pacific Northwest

- 319 Nonpoint Source Management Program Implementation
- Reducing Lead in Drinking Water Grant Program (SDWA §1459B)
- Assistance for Small and Disadvantaged Communities Grants: Small, Underserved, and Disadvantaged Community Grant Program (SUDC), Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) and Drinking Water Infrastructure Resilience & Sustainability (SDWA §1459A)
- Sewer Overflow and Stormwater Reuse Municipal Grants (OSG)
- USMCA Implementing Legislation (Section 821 and Title IX, USMCA Supplemental Appropriations, 2020)
- U.S.-Mexico Border Water Infrastructure Program
- Voluntary School and Child Care Program Lead Testing and Remediation Grant Program (SDWA 1464(d))
- Water Infrastructure Finance and Innovation Act (WIFIA)

The questions and answers in this document apply to the implementation of BABA requirements for the Office of Water infrastructure programs listed above unless superseded by regulation, statute, or other applicable guidance. For many of the programs listed above which did not have domestic preference requirements prior to BABA, additional implementation details are pending or may be developed after the issuance of these procedures. In addition, EPA notes that more direction will be helpful to inform the determination and definition of domestic content in manufactured goods. Supplemental guidance on these and other issues, from either OMB or EPA, may be forthcoming. These implementation procedures may also apply to additional, unlisted EPA programs which may be required to apply BABA subsequent to publication of this memorandum (e.g., future funding programs which have been authorized, but not yet appropriated).

For more information on the BABA requirements, visit the EPA Office of Water's dedicated website – https://www.epa.gov/cwsrf/build-america-buy-america-baba – or contact your funding authority (such as your grants officer, portfolio manager, or state contact). For information on approved waivers, visit https://www.epa.gov/cwsrf/build-america-buy-america-baba-approved-waivers. You may also email questions to BABA-OW@epa.gov.

This Implementation Procedures document is organized to provide responses to questions in the following topic areas:

QUESTIONS AND ANSWERS

SECTION 1: GENERAL

- Q1.1: Will EPA provide documentation for BABA for bid solicitations and suggested contract language? Will EPA provide suggested language for Assistance Agreements?

    - A1.1: See Appendix 1, which includes suggested language for construction contracts which addresses the BABA requirements. In addition to the language suggested in Appendix 1, EPA also recommends that assistance recipients prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: "By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the certifications are sufficient to demonstrate compliance with Build America, Buy America Act requirements." In most cases, the assistance recipient's representatives assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

      All Federal Financial infrastructure assistance agreements subject to BABA must have a clause requiring compliance with the requirements. See Appendix 2 for example assistance agreement language.

- Q1.2: Would federally-financed infrastructure projects outside of the United States need to comply with the BABA requirements?

    - A1.2: No. According to the OMB Guidance (M-22-11), a "project" is defined as "...any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States." Therefore, the BABA requirements are not implicated for infrastructure projects occurring outside of the United States, such as projects funded through the United States-Mexico-Canada Agreement with infrastructure activities occurring in Mexico or Canada (that is, outside the United States).
    -

- Q1.3: If most of the project is BABA compliant, and a small portion is not, can an assistance recipient self-fund (i.e., paying with non-federal dollars) the non-compliant products?

    - A1.3: Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. All iron, steel, manufactured products, and construction materials used in a project must meet the BABA requirements unless waived. Absent a waiver, there is no "small portion" or product that does not need to satisfy the BABA requirements unless the requirements are waived (or specifically excluded as is the case for cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products). An assistance recipient may request a waiver or inquire as to whether a broad waiver, such as a *de minimis* waiver, might apply.

- Q1.4: How do international trade agreements affect the implementation of the BABA requirements?

    - A1.4: The BABA requirements apply in a manner consistent with United States obligations under international trade agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to these trade agreements. In general, assistance recipients are not signatories to such agreements, so these trade agreements have no impact on BABA implementation. In the few instances where such an agreement applies to a municipality, that municipality is responsible for determining its applicability and requirements and communicating with the funding authority (such as EPA and/or a state) on the actions taken to comply with BABA.

SECTION 2: PRODUCT COVERAGE

- Q2.1: For products made of iron and steel, what is the difference between predominantly and primarily iron and steel?

    - A2.1: EPA considers the terms "predominantly" and "primarily" to be interchangeable, such that a product is considered predominantly (or primarily) iron and steel if it contains greater than 50 percent iron and steel by material cost.

- Q2.2: What is the definition of construction materials (with examples)?

    - A2.2: From OMB Guidance M-22-11: "construction materials" include an article, material, or supply (other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products) that is or consists primarily of:
        - non-ferrous metals,
        - plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), (including optic glass),
        - lumber, and
        - drywall.

      For example, a plate of glass would be a construction material under BABA, but a framed window that incorporates the glass into a frame would be a manufactured product. Another common construction material for water infrastructure projects would be polyvinyl chloride (PVC) pipe and fittings. However, if PVC components are incorporated into a more complex product such as instrumentation and control equipment or a water treatment unit, those items would be manufactured products.

- Q2.3: What are manufactured products (with examples)?

    - A2.3: From OMB Guidance M-22-11: "...all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total

cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation…"

The manufactured products category would cover the majority of potential water infrastructure products, including complex products made up of a variety of material types and components. For water infrastructure projects, common manufactured products would include, but not be limited to, pumps, motors, blowers, aerators, generators, instrumentation and control systems, gauges, meters, measurement equipment, treatment equipment, dewatering equipment, actuators, and many other mechanical and electrical items.

- Q2.4: Which category will valves fall under for BABA? Will it differ from the American Iron and Steel (AIS) requirements?
    - A2.4: For programs that are subject to BABA and AIS (SRF, WIFIA, and Community Project Funding), projects using valves should classify them as iron and steel products under BABA as long as their material cost is made up of more than 50 percent iron and/or steel. Valves with 50 percent or less iron and/or steel by material cost would be considered manufactured products under the BABA requirements.

      In accordance with OMB Guidance M-22-11, an article, material, or supply should be classified into only one of the three categories: iron and steel, manufactured products, or construction materials. Under the AIS requirements, all valves made primarily of iron and steel (that is, those with iron and/or steel material cost greater than 50 percent) must comply with the AIS requirements. For BABA, EPA interprets Section IV of OMB Guidance M-22-11 to mean that iron and steel products are those items that are primarily iron and steel, the same as for the AIS requirements.
- Q2.5: Does EPA have a list of products to be classified as "Iron and Steel" under BABA?
    - A2.5: Although this list is not comprehensive, the following products were classified as AIS products if made primarily (more than 50 percent) of iron and/or steel by materials cost (for programs subject to both AIS and BABA, this list would be equivalent for "iron and steel" items or products under either requirement):

Products likely made "primarily" of iron and steel to be classified as Iron and Steel under BABA		
Lined and Unlined Pipe	Lined and Unlined Fittings	Tanks
Flanges	Pipe Clamps and Restraints	Structural Steel
Valves	Hydrants	Pre-Cast, Iron/Steel Reinforced Concrete (of all types, regardless of iron/steel content percentage)
Manhole Covers and other Municipal Castings	Access Hatches	Ballast Screens
Iron or Steel Benches	Bollards	Cast Bases
Cast Iron Hinged Hatches	Cast Iron Riser Rings	Catch Basin Inlets
Cleanout/Monument Boxes	Construction Covers and Frames	Curb and Corner Guards

Products likely made "primarily" of iron and steel to be classified as Iron and Steel under BABA		
Curb Boxes	Curb Openings	Curb Stops
Detectable Warning Plates	Downspout Shoes	Drainage Grates
Drainage Grate Frames and Curb Inlets	Inlets	Junction Boxes
Lampposts	Manhole Rings and Frames	Manhole Risers
Meter Boxes	Service Boxes	Steel Hinged Hatches
Steel Riser Rings	Trash Receptacles	Tree Grates
Tree Guards	Trench Grates	Valve Boxes
Valve Box Covers and Risers	Access Ramps	Aeration Pipes and Fittings (separate from aeration/blowers)
Angles	Backflow Preventers/Double Check Valves	Baffle Curtains
Iron or Steel Bar	Bathroom Stalls	Beam Clamps
Cable Hanging Systems	Clarifier Tanks	Coiled Steel
Column Piping	Concrete Reinforcing Bar, Wire, and Fibers	Condensate Sediment Traps
Corrugated Pipe	Couplings	Decking
Digestor Covers	Dome Structures	Door Hardware
Doors	Ductwork	Expansion Joints
Expansion Tanks (diaphragm, surge, and hydropneumatics)	Fasteners	Fencing and Fence Tubing
Fire Escapes	Flanged Pipe	Flap Gates
Framing	Gate Valves	Generic Hanging Brackets
Grating	Ground Testing Boxes	Ground Test Wells
Guardrails	HVAC Registers, Diffusers, and Grilles	Joists
Knife Gates	Ladders	Lifting Hooks, J-bar, Connectors within, and Anchors for Concrete
Lockers	Man Baskets and Material Platforms	Manhole Steps
Mud Valves	Municipal Casting Junctions	Non-mechanical (aka stationary) Louvers and Dampers
Overhead Rolling Doors/ Uplifting Doors (manual open, no motor)	Pipe Connectors	Pipe Hangers
Pipe Pilings (any type of steel piling)	Pipe Spool (pipe, flanges, connectors, etc.)	Pipe Supports
Pitless Adaptors	Pre-fab Steel Buildings/Sheds (simple structure, unfurnished)	Pre-stressed Concrete Cylinder Pipe (PCCP)
Railings	Reduced Pressure Zone (RPZ) Valves	Roofing
Service Saddles	Sheet Piling	Sinks (not part of eyewash systems)
Solenoid Valves	Stairs	Static Mixers
Stationary Screens	Surface Drains	Tapping Sleeves
Telescoping Valves	Tipping Buckets	Trusses
Tubing	Valve Stem Extensions	Valve Stems (excluding handwheels and actuators)
Wall Panels	Wall Sleeves/Floor Sleeves	Welding Rods
Well Casing	Well Screens	Wire
Wire Cloth	Wire Rod	Wire Rope and Cables

Q2.6: Does EPA have a list of products that could be made "primarily" of iron and steel but would be classified as "manufactured products" under BABA?

A2.6: Although this list is not comprehensive, the following products would be considered "manufactured products" under the BABA requirements, even if the item might be composed primarily of iron and steel by materials cost (Note: These items are not subject to the AIS requirements.):

Products likely made "primarily" of iron and steel to be classified as Manufactured Products under BABA		
Actuator Superstructures/ Support Structures	Aeration Nozzles and Injectors	Aerators
Analytical Instrumentation	Analyzers (e.g., ozone, oxygen)	Automated Water Fill Stations
Blowers/Aeration Equipment	Boilers, Boiler Systems	Chemical Feed Systems (e.g., polymer, coagulant, treatment chemicals)
Chemical Injection Quills	Chemical Injectors	Clarifier Mechanisms/Arms
Compressors	Controls and Switches	Conveyors
Cranes	Desiccant Air Dryer Tanks	Dewatering Equipment
Dewatering Roll-offs	Disinfection Systems	Drives (e.g., variable frequency drives)
Electric/Pneumatic/Manual Accessories Used to Operate Valves (such as electric valve actuators)	Electrical Cabinetry and Housings (such as electrical boxes/enclosures)	Electrical Conduit
Electrical Junction Boxes	Electronic Door Locks	Elevator Systems (hydraulic, etc.,)
Emergency Life Systems (including eyewash stations, emergency safety showers, fire extinguishers, fire suppression systems including sprinklers /piping/valves, first aid, etc.)	Exhaust Fans	Fall Protection Anchor Points
Fiberglass Tank w/Appurtenances	Filters (and appurtenances, including underdrains, backwash systems)	Flocculators
Fluidized Bed Incinerators	Galvanized Anodes/Cathodic Protection	Gear Reducers
Generators	Geothermal Systems	Grinders
Heat Exchangers	HVAC (excluding ductwork)	HVAC Dampers (if appurtenances to aerators/blowers)
HVAC Louvers (mechanical)	Intake and Exhaust Grates (if appurtenances to aerators/blowers)	Instrumentation
Laboratory Equipment	Ladder Fall Prevention Systems	Ladder Safety Posts
Lighting Fixtures	Lightning and Grounding Rods	Mechanical or Actuated Louvers/Dampers
Membrane Bioreactor Systems	Membrane Filtration Systems	Metal Office Furniture (fixed)
Meters (including flow, wholesale, water, and service connection)	Motorized Doors (unit)	Motorized Mixers
Motorized Screens (such as traveling screens)	Motors	Pelton Wheels
Pipeline Flash Reactors (similar to injectors)	Plate Settlers	Precast Concrete without Iron/Steel Reinforcement

Products likely made "primarily" of iron and steel to be classified as Manufactured Products under BABA		
Furnished Pre-fab Buildings (such as furnished with pumps, mechanics inside)	Presses (including belt presses)	Pressure Gauges
Pump Cans/Barrels and Strainers	Pumps	Mechanical Rakes
Safety Climb Cable	Sampling Stations (unless also act as hydrant)	Scrubbers
Sensors	Sequencing Batch Reactors (SBR)	Steel Shelving (fixed)
Slide and Sluice Gates	Spray Header Units	Steel Cabinets (fixed interior/furniture)
Supervisory Control and Data Acquisition (SCADA) Systems	Tracer Wire	Valve Manual Gears, Actuators, Handles
Voltage Transformer	Water Electrostatic Precipitators (WESP)	Water Heaters
Weir Gates		

- Q2.7: Is asphalt paving a covered product under BABA?
    - A2.7: No. EPA interprets Section 70917(c) of the IIJA to exclude asphalt from BABA requirements. Asphalt paving is a type of concrete composed of an aggregate material mixed with a binder (bitumen). EPA considers asphalt concrete to be excluded by section 70917(c) due to its similarities with cement and cementitious materials.

SECTION 3: CO-FUNDING

- Q3.1: If projects are co-funded with funding mechanisms that don't require BABA, must the entire project comply with BABA?
    - A3.1: Yes. Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all the contracts and assistance agreements awarded are closely related in purpose, time, and place. This precludes the intentional splitting of projects into separate and smaller contracts or assistance agreements to avoid BABA's applicability on some portions of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreements would carry separate requirements.

- Q3.2: How will project requirements be determined for co-funded projects subject to potentially different general applicability/programmatic waiver conditions (such as different adjustment period waivers)?

    - A3.2: OMB Guidance M-22-11 addresses cases with project co-funding from separate programs. EPA would apply the guidance's "cognizant" program determination to projects that are co-funded with different general applicability/programmatic waivers. For instance, if a project were co-funded between WIFIA and SRF and the majority of the Federal funding for the project is from WIFIA, then WIFIA would be the "cognizant" program for application and determination of waivers. In that case, any conditions from an applicable WIFIA waiver would apply.

SECTION 4: WAIVERS

- Q4.1: Who may apply for a waiver and how do you apply?

    - A4.1: Assistance recipients and their authorized representatives may apply for a project-specific waiver. EPA does not accept waiver requests from suppliers, distributors, or manufacturers unless the assistance recipient endorses and submits the request on its own behalf to the funding authority. In the case where multiple programs are providing federal funds to the project, the assistance recipient should submit the waiver request to the cognizant program, the one providing the greatest amount of federal funds for the project. For information on applying for cost waivers, see questions 4.4 and 4.5. For information on the SRF program roles and responsibilities, see question 7.6.

      Project-specific waiver requests should generally include: (1) a brief summary of the project, (2) a description and explanation of the need for the waiver for the product(s) in question, (3) a brief summary of the due diligence conducted in search of domestic alternatives (which could include correspondence between assistance recipient and supplier/distributors), (4) the quantity and materials of the product(s) in question, (5) all engineering specifications and project design considerations relevant to the product(s) in question, (6) the approximate unit cost of items (both foreign and domestic) in addition to an estimated cost of the materials and overall project, (7) the date any products will be needed on site in order to avoid significant project schedule disruptions, and (8) any other pertinent information relevant to EPA's consideration of the waiver (e.g., if relevant for SRF projects: whether the project is designated as an equivalency project, the date the plans and specifications were submitted to the state, the date of construction initiation, expected date of project completion, any special considerations such as local zoning and building ordinances, seismic requirements, or noise or odor control requirements).

      In the case of indirect federal assistance, such as the SRF programs, the state authority reviews and conveys the waiver request to EPA. States should submit waiver requests to the appropriate program waiver request inbox. For SRF projects, please use CWSRFWaiver@epa.gov or DWSRFWaiver@epa.gov.

- Q4.2: Can an assistance recipient request a waiver based on a specification written for a specific brand or model of product (that is, a specification that names a branded item or model)?

    - A4.2: In most cases, performance-based specifications are expected and required for the majority of infrastructure projects funded by EPA's financial assistance programs. In rare cases where "branded" or product-specific sourcing may be included in project specifications, it is suggested that the specifications include the item in question (that is, not simply a catalog page, but also materials of construction, sizing, quantities, and applicable engineering performance design characteristics for the project, etc.) in addition to the standard phrase "or equal." For the purposes of product alternative market research, EPA will evaluate the BABA requirements based on performance-based engineering specifications for the product(s) in question. If the project's specifications do not include performance-based specifications, or at least an "or equal" designation, EPA will base its research on an "or equal" designation using best professional judgment to the extent practicable.

- Q4.3: If a manufactured product is not readily available domestically, will EPA provide short-term "limited availability" product waivers?

    - A4.3: EPA will address the unavailability of domestic products through the waiver process, including potential national short-term waivers for specific products, if appropriate. To the extent practicable and with the intent to maximize domestic market and supply chain development, EPA intends to address issues of broad product unavailability with targeted, time-limited, and conditional waivers, as prescribed in OMB Guidance M-22-11. EPA will follow its robust and thorough product research processes (those put into place for the AIS requirements for the SRF and WIFIA programs and expanded for the new BABA requirements) to identify and determine those products for which proposed national/general applicability waivers may be appropriate.

- Q4.4: What information is needed when applying for a cost waiver under BABA?

    - A4.4: As part of the cost waiver request, the assistance recipient must demonstrate that implementation of the BABA requirements will increase the overall project cost more than 25 percent. Depending on the circumstances of the overall project cost increases, documentation to justify the cost waiver can vary but may include itemized cost estimates or bid tabulations comparing project costs with and without BABA implementation. Assistance recipients should begin assessing the potential cost impacts of the BABA requirements during the design phase of a project.

- Q4.5: Can administrative costs associated with tracking and verification of certifications be considered when determining if the cost of a project increases by 25 percent or more?

    - A4.5: Yes. Section 70914(b)(3) of the IIJA states that a waiver may be provided if the overall cost of the project increases by more than 25 percent due to the "inclusion of iron, steel, manufactured products, or construction materials produced in the United States." EPA interprets this to mean that the "inclusion" of the BABA-covered products could encompass

reasonable administrative costs associated with complying with the BABA requirements, such as staff, contractor, and technological resources to collect and track BABA compliance documentation.

- Q4.6: How can assistance recipients and construction contractors address product delivery delays?
    - A4.6: Assistance recipients should reasonably plan for material procurement to account for known potential supply chain issues or extended lead times and shall notify the funding authority well in advance of the issues so that prompt attention can be given to explore options. Where extended lead times for compliant products are impacting project schedules and may significantly impact construction progress, timely communication with the funding agency is important. For products that are unavailable within a reasonable timeframe to meet the objectives and schedule of a project, EPA may consider a non-availability waiver with adequate justification. An assistance recipient would need to apply for the waiver and contact its funding authority (such as EPA and/or a state) to initiate the waiver process.

SECTION 5: DOCUMENTING COMPLIANCE

- Q5.1: Who will be responsible for BABA enforcement?
    - A5.1: Responsibility for BABA implementation applies at all levels, from manufacturers to suppliers and distributors, construction contractors, assistance recipients, and funding authorities.

      The manufacturers have responsibility to provide adequate and accurate documentation of the products manufactured. If suppliers and distributors are involved, they are responsible for passing along compliance documentation for products supplied to projects that are subject to the BABA requirements.

      The assistance recipient and their representatives are primarily responsible for ensuring the documentation collected for products used on the project is sufficient to document compliance with the BABA requirements.

      The funding authority is responsible for providing oversight and guidance as needed to ensure the proper implementation of the requirements. The Uniform Grants Guidance (UGG) (Title 2 of the Code of Federal Regulations (CFR) Part 200) applies to many Federal financial assistance agreements that will include BABA requirements. The general provisions of 2 CFR Part 200 determine the responsible party for the grant funding authority.

      For information on SRF program roles and responsibilities, see question 7.6.

      At all levels, where fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: http://www.epa.gov/oig/hotline.htm.

- Q5.2: When will the BABA requirements be assessed for compliance? Do assistance recipients need to have waivers for potential non-domestic products before assistance agreements are in place, at the time products are procured or products are incorporated into the project (i.e., used)?

    - A5.2: Compliance is assessed where the domestic product is used (or installed) at the project site. Proper compliance documentation, whether it is a BABA certification letter or a waiver, should accompany a product prior to its "use", in accordance with Section 70914(a) of IIJA. This may occur prior to assistance agreements being in place but is not necessary. Additionally, communication of BABA requirements through appropriate Terms and Conditions in financial assistance agreements and in project solicitation and contract documents is key in ensuring all parties involved are informed of the requirements for the project before construction is underway.

- Q5.3: How can product compliance with the BABA requirements be demonstrated?

    - A5.3: Assistance recipients and their representatives should ensure that the products delivered to the construction site are accompanied by proper documentation that demonstrate compliance with the law and be made available to the funding authority upon request. The documentation may be received and maintained in hard copy, electronically, or could be embedded in construction management software. The use of a signed certification letter for the project is the most direct and effective form of compliance documentation for ensuring products used on site are BABA-compliant prior to their installation; however, other forms of documentation are also acceptable as long as collectively, the following can be demonstrated:

        (1) Documentation linked to the project. For example, this can be in the form of the project name, project location, contract number, or project number.
        (2) Documentation linked to the product used on the project. For example, description of product(s) (simple explanation sufficient to identify the product(s)), or an attached (or electronic link to) purchase order, invoice, or bill of lading.
        (3) Documentation includes statement attesting that the products supplied to the assistance recipient are compliant with BABA requirement. Reference to the Infrastructure Investment and Jobs Act ("IIJA") or the Bipartisan Infrastructure Law (BIL) are also acceptable. For iron and steel items under BABA, references to the American Iron and Steel (AIS) requirements are also acceptable and reciprocal with BABA for such items.
        (4) Documentation that manufacturing occurred in the United States, which could include, for example, the location(s) of manufacturing for each manufacturing step that is being certified. It is acceptable for manufactured products to note a single point of manufacturing, documenting that the final point of manufacturing is in the United States. Note that each BABA category may require different determinations for compliance.
        (5) Signature of company representative (on company letterhead and signature can be electronic). The signatory of the certifying statement affirms their knowledge of the manufacturing processes for the referenced product(s) and attests that the product meets the BABA requirements.

In addition to compliance documentation, assistance recipients or their representatives should also conduct a visual inspection of the product when it arrives to the project site, especially for iron and steel products which are often stamped with the country of origin. (Note: A country of origin stamp alone is not sufficient verification of compliance with BABA and assistance receipts should not rely on it to ensure compliance.)

EPA may develop alternative procedures for demonstrating compliance. Additional project- or program-specific instructions may be developed on a case-by-case basis in order to meet individual circumstances.

- Q5.4: Will EPA provide a form or template for tracking and documenting compliance?
    - A5.4: EPA does not require a specified format for tracking or documenting compliance. Assistance recipients are free to develop any system (from simple to complex software) for tracking items used on the project and the accompanying compliance documentation, e.g., certification letters, applicable waivers, if it helps with implementation and compliance. Elements that may help with keeping track of compliance may include: product description, quantity required/used, product category (i.e., iron and steel, manufactured product, or construction material), status of obtaining certification letter, product cost, and whether the item might qualify as *de minimis*, or qualify under another applicable waiver.
- Q5.5: If a manufacturer claims to comply with the Buy American Act, does it also comply with BABA?
    - A5.5: No. With the exception of the AIS requirements – which EPA interprets to be equivalent to the "iron and steel" requirements under BABA – EPA does not have an interpretation about the comparability of other domestic preference requirements relative to BABA. Any products that are to be certified as compliant with BABA should include a specific reference to the BABA requirements and appropriate attestation from a responsible manufacturing company official. See Question 5.3 for EPA's recommendations for BABA certification letters.
- Q5.6: How will assistance recipients manage certification letters for hundreds, possibly thousands of products?
    - A5.6: EPA recognizes that the new BABA requirements will cover most products used in typical water and wastewater infrastructure projects, and that the number of items which may require certification at large and/or complex projects may reach several hundred. EPA is concerned about the potential administrative burden that this would place on assistance recipients. EPA recommends that projects with a high number of potentially covered products meet with their funding authority about potential compliance strategies to minimize burden and streamline compliance activity. Assistance recipients should prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: "By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the documentation is sufficient to demonstrate compliance with Build America,

Buy America Act requirements." In most cases, the assistance recipient's representatives may assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

- Q5.7: Who is responsible for documenting the 55 percent content requirement for manufactured products under BABA? What if the final manufacturer cannot trace or verify domestic origin for all components?

    - A5.7: The manufacturer who signs a certification letter is responsible for documenting compliance with any of the three categories of products (iron and steel, manufactured products, or construction materials). For manufactured products, BABA requires that greater than 55 percent of the total cost of all components of the manufactured product be from domestic sources. EPA recommends that the certification letter for manufactured products document whether the item passes the content test in the final product along with a statement attesting to compliance with the BABA requirements for manufactured products.

- Q5.8: How do final product fabricators document compliance when the final step of manufacturing may be simply assembling components?

    - A5.8: It is acceptable, in many cases, especially for highly complex manufactured products that utilize many sub-components, for the final point of assembly to certify without using a "step certification" process. Multiple certifications (i.e., step certifications) or a singular certification can be used for a product, as long as the certifying official is willing to attest to the product's compliance with BABA requirements at all stages of manufacturing.

- Q5.9: Will Material Test Reports be acceptable in lieu of a BABA certification for iron and steel?

    - A5.9: Material Test Reports (MTRs, commonly referred to as "Mill Certifications" or "Mill Certs") provide the chemical composition of steel and iron from a mill or foundry. If an MTR accompanies the delivery of steel or iron to a project site with an invoice or bill of lading, EPA will consider it sufficient to demonstrate compliance (equivalent to a certification letter) as long as the MTR includes a manufacturer representative's signature in addition to the location (city and state) of the mill/foundry. It is common for MTRs to be the first letter in a "step certification" if the product is further fabricated or painted, etc., by another manufacturer.

- Q5.10: Can a manufacturer use a fillable certification letter for products?

    - A5.10: EPA recommends that certifications be signed by representatives of the manufacturing entity. EPA does not oppose manufacturers using forms to internally develop letters within their company, thereby providing signed, non-manipulable certification letters to suppliers, distributors, and/or assistance recipients. A fillable form that can be changed by someone outside of the manufacturer after signature does not demonstrate compliance and may create compliance concerns for the manufacturer or assistance recipient.

- Q5.11: Are product certifications from suppliers and distributors allowed?

    - A5.11: EPA recommends that representatives of product manufacturers certify compliance and discourages suppliers and distributors from creating certification letters. EPA does not rule out the possibility that a third-party certification process, such as a certification by a distributor, may be viable. However, EPA is currently not aware of a system or proposed system that meets the EPA's recommendations for documentation of product certification.

- Q5.12: How long should assistance recipients keep compliance documentation?

    - A5.12: Assistance recipients should apply recordkeeping requirements for the project according to the procedures dictated by the funding authority. For most EPA grant programs, this is prescribed in the UGG at 2 CFR 200.334-200.338; e.g., the SRF programs require a minimum of three years. Other funding programs may require longer documentation retention periods.

SECTION 6: PROGRAMS WITH AMERICAN IRON AND STEEL REQUIREMENTS

- Q6.1: Does BABA supersede the American Iron and Steel (AIS) Requirements?

    - A6.1: The BABA requirements for items considered "iron and steel" are equivalent to those for covered iron and steel products under the AIS requirements in the Clean Water Act and the Safe Drinking Water Act. These requirements apply to the CWSRF, DWSRF, WIFIA, and Water infrastructure Community Grants. BABA includes a "Savings Provision" (Section 70917(b)) that states that BABA does not affect existing domestic content procurement preferences for infrastructure projects funded by Federal financial assistance programs that meet the requirements of section 70914. EPA views the AIS requirements as meeting the "iron and steel" product requirements of BABA Section 70914, as they both include the key requirement that items made of iron and steel be wholly manufactured in the United States from the point of melting and/or pouring the iron or steel components through final manufacturing step. Because of the "Savings Provision" of Section 70917, the AIS requirements satisfy the "iron and steel" requirements of BABA. For the programs that have AIS requirements, EPA intends to implement BABA requirements the same way for iron and steel items as it has done for AIS products.

- Q6.2: For iron and steel products, does a manufacturer need to demonstrate compliance from initial melting through the finished product?

    - A6.2: For iron and steel products, the BABA requirements are the same as the existing AIS requirements, in that all of the iron and steel in a covered product (that is, the product is comprised of more than 50 percent iron and steel by material cost) must be melted and poured in the United States and all subsequent manufacturing processes (such as grinding, rolling, bending, reheating, and casting) must occur in the United States.

Q6.3: Will EPA apply the same manufacturing standards for BABA iron and steel products as for the American Iron and Steel (AIS) requirements?

- A6.3: Yes. For AIS, EPA did not require raw materials used in the production of steel or iron to be domestically sourced. For BABA, EPA interprets the requirements to be the same. Hence, like AIS, raw materials in the production of iron and steel subject to BABA requirements would not need to be domestically sourced. The key step for both AIS and BABA domestic iron and/or steel production is the melting/pouring (that is, the location of the furnace), which must be in the United States.

- Q6.4: Will the certification process be similar to the process established for the American Iron and Steel requirements?

  - A6.4: EPA expects the certification process for the BABA requirements to be very similar to that established for the AIS requirements. For iron and steel products, the process should remain the same for AIS and BABA. EPA recommends for manufactured products and for construction materials that certification letters include direct reference to the product/material content requirements under BABA, in addition to an affirmative statement verifying that the product meets the BABA requirements.

- Q6.5: Will duplicate certification letters be required for AIS and BABA for iron/steel products?

  - A6.5: No. Compliance with BABA requirements will be sufficient to demonstrate compliance with AIS requirements for iron and steel products. If a project is subject to BABA, the only demonstration of compliance necessary is with the BABA requirements, of which the iron and steel requirements are equivalent to those of the AIS statutory requirements: the iron or steel in a product made primarily or predominantly of iron and steel (comprising more than 50 percent iron and steel by material cost) must be melted and/or poured in the United States and all subsequent manufacturing processes must occur in the United States.

SECTION 7: PROGRAM-SPECIFIC ISSUES

- Q7.1.: How do the BABA requirements apply to Community Grants?

  - A7.1: The Community Project Funding/Congressionally Directed Spending grants for the construction of drinking water, wastewater, and stormwater infrastructure and for water quality protection are subject to the requirements specified in the explanatory statement accompanying the Consolidated Appropriations Act (Explanatory Statement for Division G of P.L. 117-13, the Consolidated Appropriations Act of 2022). The explanatory statement asserts: "Applicable Federal requirements that would apply to a Clean Water State Revolving Fund or Drinking Water State Revolving Fund project grant recipient shall apply to a grantee receiving a CPF grant under this section." Therefore, the federally funded Community Project Funding/Congressionally Directed Spending grants are subject to the same requirements that apply to CWSRF or DWSRF projects, including BABA and AIS requirements. See also A1.2.

- Q7.2: Should SRF projects covered by the BABA SRF Projects Design Planning Adjustment Period Waiver follow the same procedures for demonstrating compliance as outlined for American Iron and Steel requirements?

    - A7.2: Yes. The SRF Design Planning Adjustment Period waiver does not waive the iron and steel requirements under BABA. The SRF programs have existing domestic preference requirements for SRF projects under CWA Section 608 and SDWA Section 1452(a)(4) (AIS requirements) to use iron and steel products that are produced in the United States. Sections 70917(a) and (b) of BIL explain the application of BABA to existing domestic preference requirements. Specifically, the savings provision in Section 70917(b) states that existing domestic preference requirements that meet BABA requirements are not affected by BABA. The statutory AIS requirements were existing at the time BABA became law and satisfy the BABA iron and steel requirements. Therefore, the statutory AIS requirements that have previously applied to SRF-funded projects will continue to do so, and compliance with AIS requirements will satisfy the BABA iron and steel requirements. Demonstration of compliance for iron and steel products will follow the AIS implementation policies for projects subject to the waiver.

- Q7.3: For SRF programs, is BABA considered a federal cross-cutting authority? (i.e., do "equivalency" rules apply?)

    - A7.3: Yes, BABA is considered a federal cross-cutting requirement that applies to SRF assistance equivalent to the federal capitalization grant (i.e., "equivalency" projects). EPA's SRF regulations at 40 CFR 35.3145 and 35.3575 require states and recipients of SRF funds equivalent to the amount of the federal capitalization grant to comply with federal cross-cutting requirements. Section 70914 of the IIJA, which states when a Buy America preference applies, explains that "none of the funds made available for a Federal financial assistance program for infrastructure…may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States." Therefore, BABA only applies to projects funded in an amount equivalent to the federal capitalization grant and not to those projects receiving funds in excess of the capitalization grant (i.e., "non-equivalency" projects). (Note: The AIS requirements continue to apply for all SRF projects, including non-equivalency projects, and all WIFIA and Community Grant projects, because equivalency does not apply.)

- Q7.4: Do the BABA requirements apply to Drinking Water State Revolving Fund set-asides?

    - A7.4: Due to requirements related to the deposit of funds in the DWSRF program, almost all of the funds used to conduct set-aside activities are Federal dollars. Therefore, Federal cross-cutting requirements must be applied to all set-aside activities. However, in the case of most set-aside activities, the cross-cutting requirements will not be implicated because of the nature of the activities conducted under the set-asides. Because the BABA requirements only apply to infrastructure, and infrastructure typically is not an eligible set-aside expenditure (with one potential exception being loans for incentive-based source water protection

measures under the Local Assistance and Other State Programs Set-Aside), the BABA requirements will not apply to most set-aside activities.

- Q7.5: What if an SRF project is refinanced using Federal financial assistance on or after May 14, 2022?

    - A7.5: If an SRF project began construction, financed from another funding source, prior to May 14, 2022, but is refinanced through an assistance agreement executed on or after that date, BABA requirements will apply to all construction that occurs on or after May 14, 2022, through completion of construction, unless a waiver applies. There is no retroactive application of the BABA requirements where a refinancing occurs for an SRF project that has completed construction prior to May 14, 2022. (Note: If SRF funding is used for the refinancing, the AIS requirements may still apply depending on the timing of construction.)

- Q7.6: What are the roles and responsibilities for SRF programs for BABA implementation?

    - A7.6: Implementation of the BABA requirements for the State Revolving Fund programs will continue the roles and responsibilities from the successful AIS implementation process.

      As with AIS, it is both the assistance recipient's and the state's responsibility to ensure compliance with the BABA requirements. The state is the recipient of a federal capitalization grant and must comply with all grant conditions, including a condition requiring adherence to BABA requirements.

      Consequently, states are strongly advised to conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance. In EPA's experience, most states conduct periodic site visits and arrange timely meetings with funded projects. Observed best practices typically include a meeting early in the process (sometimes before bid and usually prior to commencing construction) and at least one project site visit during the construction process. Assistance recipients must maintain documentation of compliance with the BABA requirements, as explained in question 5.3. The documents must be kept by the assistance recipient and should be reviewed by the state during project reviews.

      The state's role in the waiver process is to review any waiver requests submitted to the state to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with the assistance recipient to help obtain complete information. Question 4.1 explains the information needed by EPA to expediently review a waiver request.

      In order to implement the BABA requirements, EPA has developed an approach for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow states, on behalf of the assistance recipients, to apply for waivers of the BABA requirements directly to EPA Headquarters. Only waiver requests received and/or endorsed from states will be considered. Pursuant to BABA, EPA has the responsibility to make findings as to the issuance of waivers to the BABA requirements.

Step-by-step SRF Waiver Process

The waiver process begins with the assistance recipient. To fulfill the BABA requirements, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American-made iron and steel, manufactured goods, and construction materials. It is essential that the assistance recipient include the BABA terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 2 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three statutory conditions is demonstrated to EPA and approved.

To apply for a project-specific waiver, the assistance recipient should email the request in the form of a Word document (.doc) or editable PDF (.pdf) to the funding program. It is strongly recommended that each state identify a person or persons for BABA communications. The state designee(s) will review the application for the waiver and determine whether the necessary information has been included (Note: More information may be provided in the future regarding what information is required to be included in waiver requests). Once the waiver application is complete, the designee will forward the application to CWSRFWaiver@epa.gov or DWSRFWaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the BABA requirements and ensuring sufficient information was provided, EPA will publish the request on its website for 15 days and receive public comment. EPA will then determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the state designee whether a waiver request has been approved or not approved as soon as such a decision has been made. Granting such a waiver is a four-step process:

1. Research – After receiving an application for a waiver, EPA will perform market research to determine whether the iron, steel, manufactured goods, or construction materials are available domestically.

2. Posting – After research, if no domestic product has been identified, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: https://www.epa.gov/cwsrf/build-america-buy-america-baba-waivers-open-public-comment.

3. Evaluation – After receiving an application for waiver of the BABA requirements, EPA will determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program and post the signed waiver on the Agency's website. The assistance recipient should keep a copy of the signed waiver in its project files.

(Note: Additional steps may be required in the future regarding the waiver process depending on additional guidance from OMB)

APPENDIX 1

Example Build America, Buy America (BABA) Act Construction Contract Language

ALL CONSTRUCTION CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE BABA REQUIREMENTS. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN A PROJECT'S CONSTRUCTION CONTRACT. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the _____ ("Owner") and the _____ (the "Funding Authority") that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as "Build America, Buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States ("Build America, Buy America Requirements") including iron and steel, manufactured products, and construction materials provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or Funding Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

APPENDIX 2

Example Build America, Buy America (BABA) Act Assistance Agreement Language

ALL FEDERAL FINANCIAL INFRASTRUCTURE ASSISTANCE AGREEMENTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE BABA REQUIREMENTS. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN AN ASSISTANCE AGREEMENT (E.G., SRF LOAN AGREEMENT). EPA MAKES NO CLAIMS REGARDING THE LEGAL SUFFICIENCY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the assistance received (including those imposed by the Infrastructure Investment and Jobs Act ("IIJA"), Public Law No. 117-58) which the Participant understands includes, but is not limited to, the following requirements: that all of the iron and steel, manufactured products, and construction materials used in the Project are to be produced in the United States ("Build America, Buy America Requirements") unless (i) the Participant has requested and obtained a waiver from the cognizant Agency[1] pertaining to the Project or the Project is otherwise covered by a general applicability waiver; or (ii) all of the contributing Agencies have otherwise advised the Participant in writing that the Build America, Buy America Requirements are not applicable to the Project.

Comply with all record keeping and reporting requirements under all applicable legal authorities, including any reports required by the funding authority (such as EPA and/or a state), such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the applicable legal requirements and this Agreement may result in a default hereunder that results in a repayment of the assistance agreement in advance of the maturity of the Bonds, termination and/or repayment of grants, cooperative agreements, direct assistance or other types of financial assistance, and/or other remedial actions.

[1] From OMB Guidance M-22-11: To avoid a need for duplicative waiver requests from entities that receive funding for one infrastructure project through multiple Federal agencies, the Federal agency contributing the greatest amount of Federal funds for the project should be considered the "Cognizant Agency for Made in America" and should take responsibility for coordinating with the other Federal awarding agencies. Such coordination will provide uniform waiver criteria and adjudication processes, minimize duplicative efforts among Federal agencies, and reduce burdens on recipients. The Cognizant Agency for Made in America shall be responsible for consulting with the other Federal awarding agencies, publicizing the proposed joint waiver, and submitting the proposed joint waiver for review to MIAO.

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MERCHANTVILLE PENNSAUKEN WATER COMMISSION
BROWNING ROAD WATER TREATMENT PLANT IMPROVEMENTS
0424M081

SCOPE OF WORK

1.01 GENERAL

In general, the work on this project consists of improvements to the Browning Water Treatment Plant (WTP) for the Merchantville Pennsauken Water Commission (MPWC). The Browning WTP is located at 4400 Frosthoffer Avenue, Pennsauken, Camden County, New Jersey on Block 5909, Lot 29. The improvements proposed at the plant include the installation of an Advanced Oxidation Process (AOP) using Ultraviolet light and Hydrogen Peroxide to treat 1,4 Dioxane and the installation of a Granular Activated Carbon (GAC) system to treat for per- and polyfluoroalkyl substances (PFAS) contamination and quench the hydrogen peroxide. The upgrades shall be installed with all necessary treated water and sanitary piping, valves, and appurtenances, electrical, instrumentation and controls, connections to the existing system, construction of a new building, and structural improvements necessary to support the structures.

Currently, the Browning WTP is serviced by two (2) groundwater supply wells, (known as Browning 2A and Browning 3A) and has a capacity of 1,900 gallons per minute (gpm). Each well will be upgraded with a UV system and a pair of GAC filters. A total of two (2) UV units and four (4) GAC filters are proposed to be installed as part of this upgrade. The improvements to the water treatment plant will be located in a new building that will be placed in front of the existing one.

Each AOP unit and GAC train shall have a capacity of at least 1,000 gpm. Each GAC train consists of two (2) vessels connected in series. The proposed water quality improvements will be installed at the end of the existing water treatment process whose components are: two (2) air strippers, a pre-filter Lime addition, a pre-filter chlorination, two (2) Green Sand Plus Sand Filters, Corrosion Inhibitor and Disinfection.

The existing facility currently includes a lime slurry feed system for pH adjustment, a polyphosphate solution feed system including Klenphos 300 for iron sequestration and corrosion control, a sodium hypochlorite solution feed system for pre-filtration oxidation and post-filtration disinfection, and a Greensand filtration system for iron removal. The upgraded facility will continue to use the same treatment processes and chemical dosing rates will remain. However, modifications will include the installation of new solution and slurry tanks, pumps and appurtenances to replace existing equipment as shown on the Plans and as required to fulfill the intent of the Plans and Specifications. The work also the installation of a new hydrogen peroxide solution feed system, complete, as part of the AOP treatment system. Start up chemicals for the new treatment systems will be provided by the Owner.

1.02 DESCRIPTION

The work of this project consists of, but is not limited to, the following:

A. Mobilize to the project site for work and provide a complete demobilization upon completion of work. Provide Bonds, Insurance, and documentation as required as part of these Contract Documents. Aside from the direct costs of Mobilization, all costs for these efforts shall be included in various line items in the proposal.

B. Contractor shall coordinate with PS&G to provide an electrical and gas service relocation that includes but is not limited to: trenching excavating, backfilling, service disconnection, installation of the electrical pole in the new proposed location as shown on Electrical Site Plan, duct bank and handholes installation, connection to the new transformer as well as service reconnection to existing buildings. Shown on the Existing Site Plan is the approximate location of the existing underground electrical line going from the pole to the transformer as well as the existing gas line. It is the Contractor's responsibility to determine the exact location of the existing electrical line through a soft dig test pit investigation, to be performed in the proximity of the transformer. The contractor shall take all the necessary precautions not to damage the electrical and gas lines.

C. The Contractor shall coordinate with PSE&G for the gas service relocation and new gas service connection to the proposed treatment building.

D. Provide all necessary site work which includes, but not limited to demolition, site clearing, soil excavation and stockpiling, site grading, test pits (conventional and soft dig as directed by engineer) and site restoration. All excess excavated soils shall be removed and disposed off-site by the contractor. In addition, the Contractor shall furnish all soil erosion and sediment control measures as identified in the contract documents. The Contractor shall be responsible for maintaining compliance throughout the project. The Owner/Engineer will not be held accountable for soil erosion control deficiencies, fines, or penalties as a result of non-compliance.

E. Contractor shall furnish, build and install the concrete masonry unit (CMU) treatment building as shown on the drawings. This shall include, but not be limited to, all excavation and backfilling, foundations, concrete and reinforced concrete work, masonry, framing, finishing, and roofing. The CMU building walls shall be insulated with material possessing a minimum R rating of 19. Roof shall be insulated with material possessing a minimum R value of 39.

F. The Contract shall install the Backwash water piping to the new building housing the improvement treatments. Backwash water supply will be sourced from the water supply tank located on the north side of the existing building housing the green sand plus sand filters.

G. Select treatment additives including iron sequestering and corrosion inhibitor agent (Klenphos 300), lime slurry and post-chlorine feed system shall be relocated from the existing locations to the proposed treatment building as shown on the Plans. The existing pre-filtration chlorine feed system including solution tank, pump, tubing, injector and controls shall remain. The Contractor shall disconnect the existing lime slurry and Klenphos 300 tanks complete of all fitting, suction and discharge feed lines, appurtenances, controls, chemical feed pumps, and piping connections and properly dispose of all materials. Contractor shall install the new slurry and solution tanks, complete of all components and connections to guarantee service operations, in the new treatment building, including the hydrogen peroxide feed system for the new advanced oxidation process, as shown on the plans. The Owner will be responsible for the disposal or relocation of existing chemical solutions and slurries.

H. A geotechnical investigation report (memo) is included as part of the bid documents. The Contractor should prepare the site as recommended in the Geotechnical Report included

in Appendix A. Procedures for preparing the site are provided in the report and should be adhered to.

I. The Contractor shall re-route existing underground utilities that will conflict with the proposed building footprint as shown on the Plans and specified in the Contract Documents.

J. Contractor shall provide all modifications to the existing facility process water and wastewater (sanitary) piping, valves, fittings, and appurtenances on the site as shown on the plans.

K. Contractor shall furnish and install the AOP system and appurtenances, as specified in the Contract Documents. The AOP system includes the UV reactors, control power panels, system control center, hydraulic system center, UVT monitor, dual containment chemical tank and piping for hydrogen peroxide dosing, and metering pump assembly skids which is supplied by the manufacturer. The AOP UV reactor, internal components, and the metering pump assembly skid shall be rated for a minimum operating pressure of 125 psi. The Contractor shall furnish and install all process piping to supply the water from the existing sand filters to the AOP units and from the AOP units to the GAC system as shown. For each AOP unit, Contractor shall install a static mixer, flow meter, sampling ports, motorized butterfly valves, and all other elements as shown on the Plans and necessary for a complete system. All treatment piping shall be installed and prepared in accordance with all NSF and NJDEP disinfection procedures prior to the system going online. The Contractor shall deliver a complete and functional system as part of the project.

L. Contractor shall be responsible for the disconnection complete of the GAC vessels located on the concrete pads, including the disconnection of all piping electrical and controls inside the existing building. Disconnection shall be performed according to the NJ rules and regulations.

M. Contractor shall install the GAC vessels and appurtenances, as specified in the Contract Documents. The vessel package must include the valve manifold supplied by the Owner which is commonly installed between a pair of vessels. The Contractor shall install all remaining process piping to connect the vessels valve manifold to the existing treatment system as shown. The vessel package must also include granular activated carbon supplied by the Owner. The GAC media and treatment units must be sufficient to remove PFOA, PFOS, and PFNA and provide a minimum of 20 minutes of empty bed contact time. All treatment piping shall be installed and prepared in accordance with all NSF and NJDEP disinfection procedures prior to the system going online.

N. Contractor shall construct a sampling sink, as shown on the Plans and as specified in the Contract Documents. A finished water sampling line shall be installed downstream of the chlorine contact pipe to supply the sampling sink. The system shall be installed to measure the chlorine and pH of the finished water and the chlorine of the process water downstream of the proposed AOP system.

O. Furnish and install process piping, valves, fittings, and appurtenances as shown on the Plans and as required to fulfill the intent of the Plans and Specifications, including, but not limited to, process piping from the Greensand filters to the AOP systems in the new building, process piping from the AOP units to the GAC system, process piping from the

GAC system to distribution, process piping to backwash the GAC system from the existing backwash supply line, process piping to carry backwash effluent from the GAC system to the backwash discharge line that feeds the discharge storage tank. Contractor shall install the process piping at ad adequate depth, in order to be able to allow the correct installation below the building foundation.

P. Furnish and install a double check valve assembly backflow preventer on the backwash supply line.

Q. Furnish and install a manual butterfly valve on the GAC system backwash supply line.

R. Contractor shall connect proposed backwash effluent piping from the GAC to the existing backwash piping.

S. Furnish and install magnetic flow meters for the plant effluent upstream and downstream of the GAC system and backwash supply line for the GAC system.

T. All exposed piping, including pipe supports, shall be painted according to the painting schedule contained in Section 099100 – Painting and Identification. Interior piping and valves shall also be painted according to the specifications. Interior pipe supports shall not be painted.

U. The Contractor shall demolish existing retention wall, regrade site as shown on grading plan, enlarge driveway and driveway access to the site, install a new access gate and install new curb and concrete apron to accommodate the proposed access enlargement, as shown on the Plans and specified in the Contract Documents.

V. The Contractor shall demolish the concrete foundation and the concrete retaining wall as shown in in Demolition Plan. The concrete pad no. 1 (closer to the existing building) shall be used to house the new proposed generator. The concrete pad no. 2 (closer to the area of the proposed building) shall be demolished and disposed.

W. Contractor shall disconnect and abandon in place the existing chlorine detention tank connecting pipes, fittings and the 14” water main as shown on the Demolition Plan. In replacement of the chlorine tank the contractor shall install a 12" chlorine contact pipe followed by a 36" chlorine contact pipe, to be connected with a 36" x 12" eccentric reducer. The 36" chlorine contact pipe connect to the existing water pipe going out the distribution, as shown on the Proposed Utility Plan. The contractor shall install the chlorine contact pipe at a depth adequate to ensure in all sections a minimum distance of 18" below the bottom of the sewer pipe. It is the Contractor’s responsibility to perform the test pit investigations shown on the Demolition Plan to verify the location of the existing utilities and take all necessary precautions not to damage and to avoid conflict.

X. The Contractor shall abandon the water line installed from the existing detention tank to the hydrant located in the area of the solar field and remove the hydrant. Also to be removed is the hydrant in the proximity of the generator, shown on the Demolition Plan.

Y. The Contractor is responsible for the installation of a new hydrant complete of the water valve and a 6” hydrant line connecting the new hydrant to the proposed water main, as shown on the Proposed Utility Plan. In addition, this work shall also include the installation of a new copper water pipe connection and chlorine sampling line to the

proposed building as well as a 4" D.I. pipe reconnection to backwash supply line in the existing building as shown on Plan. Install all water mains at a minimum dept of 4' and with adequate offsets to avoid potential conflicts with existing piping.

Z. Contractor shall remove and dispose the existing Terracotta sewer pipe shown on the Demolition Plan, in the area between the fence line and the existing and proposed buildings. The Contractor shall install a new MH to connect to the existing ones with rims 23.49 and 24.89. Relocate the sewer segment from MH with rim 23.49 to MH with rim 24.89, with an 8" PVC line approximately 7' from the fence line and connecting to the new manhole.

AA. The Contractor shall perform a minimum of 2 test pit investigations in the areas shown on the drawings. The objective is: to confirm the location and dept of the existing piping, provide offset and precautions as necessary to protect the existing piping.

BB. The Contractor shall extend the paved driveway as shown on Plans and construct a 4' high loading dock as shown on Plans.

CC. The Contractor shall provide a new motor and variable frequency drive (VFD) for high service pump #1 and #2 within the building housing the high service pumps.

DD. The Contractor shall provide for the complete disinfection, testing, and start-up of the new facilities as required by the Contract Documents.

EE. Upon completion of construction of all new facilities, the contractor shall complete all site restoration work, including the driveway pavement, as required by the Contract Documents.

FF. The complete testing and startup of the entire new facilities and placing the new facilities into permanent service. This work shall include providing the services of factory-trained technicians for all equipment required to complete the necessary startup of the facilities as further specified in these specifications. In addition, this work shall also include providing a complete set of plant finished water analysis as further specified in these specifications. All water quality analysis shall be performed by a licensed laboratory certified by the State of New Jersey Department of Environmental Protection to perform drinking water analysis for public community water systems.

Mechanical, Electrical, and Plumbing Scope of Work

A. Coordinate with PSE&G to install a gas line from the street and/or relocate the existing gas line to the proposed CMU building, including a meter on the side of the building near the door. The Contractor shall coordinate and schedule all work with PSE&G. All costs paid to PSE&G, if any, shall be paid for by the Contractor and reimbursed under the Bid Item "Allowance for Road Opening/Construction Permits, if & where directed by the Owner," with a 5% markup.

B. The Contractor shall provide new unit heaters to serve the new building as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall provide new thermostats to serve the gas fired unit heaters as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall provide new

electrical power circuits to serve the new gas unit heaters, including but not limited to circuit breakers, conductors, raceways, etc.

C. The Contractor shall provide new sidewall mount exhaust fans to serve the proposed chemical rooms as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall provide new electrical power circuits to serve the new exhaust fans, including but not limited to circuit breakers, conductors, raceways, etc.

D. The Contractor shall provide new ventilations systems, complete, to serve the proposed chemical rooms as indicated on the contract drawings and as specified in the contract specifications.

E. The Contractor shall provide one (1) new desiccant dehumidification unit, diffusers, registers, and ductwork to serve the new conditioning plant as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall provide a new humidistat to serve the new dehumidification unit as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall provide new electrical power circuits to serve the new dehumidification unit, including but not limited to: circuit breakers, conductors, raceways, etc.

F. The Contractor shall provide testing, adjusting, and balancing (TAB) for all proposed mechanical equipment as indicated on the contract documents and as specified in the contract specifications.

G. The Contractor shall provide new floor drains and floor cleanouts to serve the new Conditioning Plant as indicated on the contract drawings and as specified in the contract specifications.

H. The Contractor shall provide new sanitary waste and vent piping, including all required supports and accessories, to serve the new floor drains as indicated on the contract documents and as specified in the contract specifications.

I. The Contractor shall provide new emergency shower/eyewash stations to serve the proposed chemical rooms as indicated on the contract drawings and as specified in the contract specifications.

J. The Contractor shall provide new mixing valves to serve the new emergency shower/eyewash stations as indicated on the contract drawings and as specified in the contract specifications.

K. The Contractor shall provide hose bibbs and sinks to serve the new building as indicated on the contract drawings and as specified in the contract specifications.

L. The Contractor shall provide a gas fired hot water heater to provide domestic hot water at the new building as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall provide the new hot water heater with intake and vent piping as indicated on the contract drawings, as specified in the contract specifications, and as recommended by the hot water heater manufacturer. The Contractor shall provide new electrical power circuits to serve the new hot water heater, including but not limited to circuit breakers, conductors, raceways, etc.

M. The Contractor shall provide one (1) expansion tank to serve the new domestic hot water system in the Conditioning Plant as indicated on the contract drawings and as specified in the contract specifications.

N. The Contractor shall provide new domestic cold-water piping and new domestic hot water piping, including all fittings, valves, supports, accessories, etc., to serve the new plumbing fixtures in the new building as indicated on the contract drawings and as specified in the contract specifications.

O. The Contractor shall provide new gas piping, including all fittings, valves, regulators, supports, accessories, etc., to serve the new gas unit heaters, new dehumidification unit, and new hot water heater as indicated on the contract drawings and as specified in the contract specifications.

P. The Contractor shall provide a sub-fed service from the existing MCC (Motor Control Center) to the new building as indicated on the contract drawings and as specified in the contract specifications.

Q. The contractor shall provide new electrical duct banks across the existing site to the proposed buildings as indicated on the contract drawings and as specified in the contract specifications.

R. The Contractor shall provide new fire alarm devices for the building as indicated on the contract drawings and as specified in the contract specifications. The Contractor shall interlock the new fire alarm devices with the existing fire alarm system in the existing building as indicated on the contract drawings and as specified in the contract specifications.

S. The Contractor shall provide new LED lighting fixtures, new electrical wiring devices and new power and control wiring for all motorized equipment and instrumentations in the new building as indicated on the contract drawings and as specified in the contract specifications.

1.03 PRECONSTRUCTION MEETING

A preconstruction meeting will be held on site prior to bidding. The date of the preconstruction meeting will be determined by the client and will be distributed by way of an addendum issued after bid authorization. The meeting will not be mandatory, but bidders are strongly encouraged to attend. Any questions or comments generated during the preconstruction meeting will be distributed via addendum.

1.04 SCHEDULE FOR QUESTIONS

Any and all questions shall be submitted to the Engineer for review 21 days prior to the bid date. This will allow the Engineer to answer questions in a timely manner and distribute an addendum to address all questions, without delaying the bid opening. Any questions submitted after that date will not be accepted.

1.05 BID ITEMS

A. Mobilization Bid Cost: Mobilization will be paid in full after 10% of the total project cost based on the other bid items is completed.

B. The Bid Form lists several lump sum items on which the Bidder will present his or her cost to perform the Work. The items shall be all inclusive of the Work that is required for a full and functioning system as shown and specified. For Work that is not specifically listed as part of a line item, but required to complete the scope, payment shall be made as part of the various items in the Contractor's bid.

C. Allowance: An allowance is provided to address any unforeseen conditions or for the replacement of any equipment found to be defective during the performance of the Contract work. It shall include work not in the contract that the Contractor is directed to perform in writing by the Owner, or the project engineer at an agreed upon price. A cost of the work shall be approved by the Owner prior to Contractor initiating the work. Any unused monies shall be retained by the Owner. Work under the allowance is subject to the conditions set forward in Section 3.1 of the General Conditions.

D. Payment items shall include, but not be limited to, the furnishing of equipment and materials, installation of the equipment, disposal of existing equipment scheduled for replacement, electrical connection, site work, disinfection, testing and start-up representation for a complete and operational system.

1.06 COORDINATION

A. Contractor shall, at no additional cost:

1) Assume full responsibility for protection and safekeeping of products stored on and off premises.
2) Not store products in locations that interfere with the operations of Owner or other Contractors. If stored products are found to interfere, Contractor is to move immediately without additional payment.
3) Obtain and pay for all storage or work areas required for his or her operations other than what are shown on the Contract Drawings
4) Coordinate onsite storage areas with Plant Operations
5) Not unreasonably encumber the site with materials and equipment.
6) Properly store all equipment onsite and insure against damage, fire and/or explosion.
7) Assume full responsibility for site safety within the work area.
8) Provide all required potable water and temporary power required to complete all work required under this contract. Connection to existing onsite utilities is permissible on a temporary basis.

1.07 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

MPWC utilizes the services of Complete Control Services (CCS), located in Egg Harbor City, NJ, for SCADA system integration. The Contractor shall utilize the services of CCS to integrate the proposed plant upgrades into the Township's existing SCADA system. The integration will include the following:

- Terminate I/O in RTU.
- Modify NDS HSU server programming.
- Modify NDS HMI screens and add new graphics.
- Modify local and remote auto controls as needed.
- Modify local controls.
- Assist in Startup and testing.

The cost for the system integration shall be included under the line item "SCADA Integration," in the Bid Form. Costs associated with the SCADA upgrades shall be paid as a lump sum item under this task.

1.08 FUNDING

A. All work on this project is being funded by loans from the NJ-Bank Drinking Water State Revolving Fund Program (formerly New Jersey Environmental Infrastructure Financing Program). Therefore, the Contractor shall follow all requirements of the Programs, including submitting all monthly manning reports for the project. In addition, all employees on-site shall be interviewed regarding the payment of prevailing wages, any costs pertaining to program requirements shall be included in the prices bid. **The Contractor must pay their employees the higher of the Federal or State prevailing wage rates, and the State prevailing wage rates will be the current rates when the contract is executed.**

B. Contractor shall account in his bid price and construction schedule for a pre-construction and monthly interim meetings with NJDEP Municipal Finance & Construction Element. Each meeting may last up to 2 hours.

C. Contractor shall meet SED Utilization goals and complete monthly and quarterly reporting throughout the project.

1.09 PERMITTING

A. Highway/Curb/Sidewalk/Road Opening/Construction Permits: Prior to initiating any work, the Contractor shall contact and gain approval from the Township/County, as appropriate. The Contractor is responsible for obtaining and paying all fees for Township/County permits. All costs for obtaining permits shall be included in the various items bid in the Proposal; Contractor to verify all required permits for this work with the Township/County.

B. Township Registration: Contractor shall become a registered Contractor within the Township. Contractor is responsible for all efforts. Registration fees shall be paid

without markup under the "Additional Work Allowance", as Directed by the Owner line item. Contractor to provide proof of registration when the executed contracts are returned to the Engineer.

C. Other permits and notifications necessary for the completion of the work shall be obtained by the Contractor based on the specific method and sequence of construction as provided for by the Contractor. These permits may include but are not limited to: traffic control, confined space extraction response, interruption of utility service, road closure, wide load escort, tree trimming, and other permits related to the work.

1.10 MISCELLANEOUS

A. The Trojan AOP UV system is supplied with a metering pump assembly skid that supplies Hydrogen Peroxide to the UV unit. The skid comes standard with a Watson Marlow QDOS60 pump. Contractor to contact manufacturer and swap the pump with a Prominent DulcoFlex Series DFBa series peristaltic pump.

B. Contractor to supply the following pumps to replace existing chemical pumps at the plant.

Sodium Hypochlorite: Prominent Gamma X Series Solenoid Metering Pump
Model Number Prominent GMXA1009NPE9N000UDO1300EN

Klenphos 300: Prominent Gamma X Series Solenoid Metering Pump
Model Number Prominent GMXA1009NPE9N000UDO1300EN

C. All process piping, equipment, valves and tanks that are used in the water treatment process shall comply with NSF/ANSI 61 standards. Specialized coatings may be used to satisfy NSF/ANSI 61 requirements.

D. Contractor shall verify all dimensions and existing conditions in the field prior to the start of the construction. Any errors or discrepancies shall be brought to the attention of the engineering immediately.

E. Location of existing utilities are approximate and must be verified in the field prior to the start of construction.

F. It is recommended that all bidders make arrangements to visit the site to verify the existing conditions and determine potential difficulties in staging of work for site conditions to be encountered prior to bid. The project site will be made accessible to the Contractor to perform a site visit upon request to verify the existing conditions. No extra monies will be paid for site and equipment contingencies. The Contractor may visit the site between 9 A.M. and 3 P.M. and shall coordinate the site visit with the plant operator and engineer to ensure the treatment plant gates and entry doors are open.

G. There will be no need for uniformed law enforcement officers on this project.

H. It is the intent of these Specifications that a complete operating monitoring and control system be provided, as further specified in the 406600 - INSTRUMENTATION AND CONTROL EQUIPMENT section of these Specifications.

1.11 START-UP SERVICES

The Contractor shall provide complete start-up services to successfully place the new treatment facilities and all new equipment, electric and controls to the satisfaction of the Owner and Engineer. The Contractor shall test all new equipment prior to scheduling a complete start-up of the new facilities. After the Contractor has, in his/her opinion, successfully tested all equipment and new facilities, the Contractor shall schedule for and conduct a complete start-up and training for all new facilities and equipment. Start-up services shall include the services of manufacturers certified or approved representatives of each major equipment provided and installed, including, but not limited to, AOP & GAC systems and appurtenant equipment, chemical feed equipment, electric, instrumentation and controls, valves, meters, analyzers and appurtenances, for a minimum of three (3) eight-hour days and two (2) additional four-hour days, at no additional cost to the Owner.

In the event a complete start-up is unsuccessful due to equipment failure, operational deficiencies or failure of bacterial coliform and radionuclide testing, that is beyond the control or responsibility of the Owner, the Contractor shall make due to correct all problems and deficiencies. This shall include, but not be limited to, re-testing equipment, re-chlorinating and re-testing water quality (if required), re-scheduling and conducting a new start-up, including providing the services of all manufacturers' representative and factory trained technicians, and all additional laboratory analysis, at no additional cost to the Owner. These services shall be repeated until a successful start-up has been completed and accepted by the Owner and Engineer.

Other sections of these specifications may include start-up services for individual items and equipment and shall be considered additional services to the start-up services included in these Specifications. It shall be understood that the Contractor can complete his/her own start-up of individual equipment and items, for testing purposes, however, this will not relieve the Contractor of the responsibility to provide for a complete start-up of the entire facilities as required for final acceptance by the Owner and Engineer. Final payment to the Contractor will be withheld until a successful start-up has been completed and accepted by the Owner and Engineer, and all other outstanding items have been completed and accepted by the Owner and Engineer.

END OF SCOPE

SECTION 010000 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Only major items of work are given in the Bid Form, but it is the intent of the specifications to secure a completely interconnected and functionable system, and if any workmanship or materials be required which are obviously necessary to carry out the full intent and meaning of the plans and specifications or to be reasonably inferred therefrom, the cost of such workmanship or materials shall be included in the unit price for the major items of work.

B. Where construction is being performed in traveled roadways, Contractor is to provide necessary traffic control and devices in accordance with the Current Manual on Uniform Control Devices.

C. Contractor shall notify all utility companies prior to construction of the work under this contract including the utility "Call Before You Dig" requirement at 1-800-272-1000 for any excavation or asphalt paving work under the contract.

D. Prior to any excavation, the Contractor shall have all utilities marked, and shall excavate or otherwise determine the exact location and elevations of said utilities. The Contractor shall notify the Engineer of any conflicts. The Contractor shall arrange for any necessary utility relocations or plan changes and shall reschedule Contractor's operations appropriately.

E. The Contractor, in the construction of any project, shall not stockpile materials or equipment on any private property; except areas designated by the plans or as directed by the Engineer. If so required, the Engineer may direct the Contractor to have Contractor's equipment removed from any project during weekend hours.

F. All work of refilling sunken ditches, repaving over trenches and keeping streets and sidewalks in passable condition shall be done to the satisfaction of the owner during the construction of the above work as well as during the maintenance period. If any work is not done within five (5) days after written notice is given by the Engineer, the work may be done by the Owner and charged to the Contractor.

G. Special care shall be taken to prevent contamination, siltation, or interfering in any way with the stream flows or ponds along the line of work. No waste matter of any kind will be allowed to discharge into the stream flows or impounded water or any ponds or other bodies of water.

H. The Contractor is hereby advised that Public Law 1975, Chapter 251, as amended by P.L. 1979, Chapter 459 is applicable to this project.

I. It is the intent of the current standards for Soil Erosion and Sediment Control to ensure that proper measures for erosion control are employed and provide for the early establishment of vegetation that will help avoid erosion problems during and after construction. It is expected that the Contractor will anticipate possible problems and provide timely and adequate control to prevent or minimize adverse effects.

J. The Contractor shall apply and pay for all permits that may be required for any of the work involved with this project. Municipalities or Authorities having an interest or jurisdiction on this project are: **Merchantville Pennsauken Water Commission, Borough of Merchantville, Pennsauken Township, and Camden County.**

K. All notes on plans shall be made a part of the specifications.

L. Contractor shall notify Engineer at least forty-eight (48) hours in advance of any work on Saturdays. There will be no work permitted on Sundays or holidays. This project will receive inspections and the normal working hours for the Inspector are from 8:00 AM to 4:30 PM, Monday through Friday. Any overtime inspection costs which are avoidable will be reimbursed by the Contractor.

M. During the construction of the project, travel lanes shall always remail open.

1.2 PUBLIC UTILITIES

A. The bidder is advised to ascertain all the facts concerning the location of existing utilities.

B. The Contractor shall cooperate with the utility owners in the adjustment of their facilities and shall notify the utility owners not less then ten (10) days in advance of the time Contractor proposes to perform any work that will endanger or affect their facilities.

C. The Contractor shall permit the owners of utilities, or their agent's access to the work site at all times in order to relocate, construct or protect their lines, and Contractor shall cooperate with them in performing this work.

D. Separate payments will not be made for the coordination and cooperation of the Contractor with the utility companies, nor for the protection or replacement of utilities as specified hereinbefore and the bidder shall include all such costs in the prices bid for the various scheduled items in the Bid Form.

1.3 PRE-CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall, at no extra cost, take DVD or digital photographs of the site prior to the commencement of construction. The DVD or photograph record shall accurately depict the existing preconstruction condition of all curbs, sidewalks, driveways, fences, lawns, landscaped areas, mailboxes, street furniture and all other appurtenances within, or outside a 25 foot radius of the limits of the construction of the project. One (1) copy of the CD photograph record or DVD shall be provided to the Engineer. The date of all disks, as well as identification as to the location which the records depict, must be provided.

1.4 MAINTENANCE AND PROTECTION OF TRAFFIC

A. The contractor shall erect or place and maintain in good conditions, barricades, warning signs, lights, rubber traffic cones, and other warning and danger signals and devices, appropriate and adequate for the specific needs and subject to the Engineer's approval at working sites, closed roads, intersections, open excavations, location of material storage, standing equipment and other obstructions, at point where the usable traffic width of the road is reduced, and at points where traffic is deflected from is vehicular or pedestrian traffic.

B. The Contractor shall provide sufficient watchmen and traffic directors and shall take all other precautions including any that may be ordered by the Engineer, which are necessary for the safety of the public and the protection of the work.

C. Before beginning work on any phase of the project the Contractor shall furnish and install all specified warning signals, barricades wood traffic guides, lights, and other devices necessary, in the opinion of the Engineer, to protect the public during that phase of the operations.

D. Road construction signs shall be placed at each end of the project along the road for the work along the public road.

E. During the work on this project, the Contractor shall provide and/or be prepared to provide traffic protection device in accordance with Part VI "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS," Current Edition. The minimum numbers set forth in the Manual shall be on hand at each separate project site prior to the commencement of any work (or phase of work) and shall be maintained available on the project site throughout the period of the project (or phase). Failure to provide and maintain the minimum number of devices specified in the Manual shall be sufficient cause for the Engineer to order cessation of the work. When lack of any required safety device presents an immediate hazard, the Engineer may order that such devices be provided by the Owner or by other Contractors, deducting the cost thereof from any monies due or becoming due by the Contractor.

F. Additional devices up to the minimum number set forth in the Manual shall be provided by the Contractor as required or directed prior to the commencement of any operation or phase of an operation requiring such devices.

G. The Contractor shall provide adequate means of access for fire, police and emergency vehicles throughout the length of the project.

H. Refer to Devision 1 for additional requirements.

1.5 REFERENCE TO THE STANDARD SPECIFICATIONS

A. Portions of the work performed under this contract shall comply with the requirements of the State of New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction 2019, and all requirements modified, as amended or supplemented and whose specifications are made part of these specifications. The New Jersey Department of Transportation Standard Construction Details shall govern except insofar as same are modified, amended or changed in detail drawings prepared specifically for this project.

B. The Standard Specifications are made part of these specifications by this reference as if they were set forth in full. It is the responsibility of the prospective bidder to be familiar with these Standard Specifications.

1.6 DUST CONTROL

The Contractor will be required to maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and all other work areas within or

outside the project boundaries free from dust which would cause a hazard or nuisance to others. Approved temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or similar methods will be permitted to control dust. Sprinkling, to be approved, must always be repeated at such intervals as to keep all parts of the disturbed area at least damp, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs. If any dust control is not done within twenty-four (24) hours after written notice is given by the Engineer, the work may be done by the Owner and charged to the Contractor. Costs for dust control shall be included in the prices bid for the various items in the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 – QUANTITY AND PAYMENT

4.1 QUANTITY AND PAYMENT

A. Unless otherwise provided for in this contract specification, no separate payment shall be made for the work associated with this section and all costs shall be included in the various items of the bid proposal.

END OF SECTION 010000

SECTION 010100 - AS-BUILT DRAWINGS

1.01 GENERAL

The Contractor shall provide a set of reproducible as-built drawings prior to final payment.

2.01 MATERIALS

A. As-builts shall be a reproducible of the original contract drawings including any additional sheets required. All deviations from the original contract drawings shall be on the as-builts. The drawings shall be legible, neat, and of a quality acceptable to the Engineer.

B. The Engineer shall provide a set of reproducibles at the beginning of the project.

3.01 EXECUTION

A. The Contractor shall be responsible for keeping the as-built up-to-date as the project progresses.

B. Building Construction: Actual installation with all items clearly identified shall be indicated. Location of installed items and any deviations from contract documents shall be so shown with boxes around the as-built numbers or labels.

C. This section is intended to provide a minimum level of acceptance. Any section with more stringent requirements shall have precedence over this section.

4.01 PAYMENT

No separate payment will be made for work performed under this section.

END OF SECTION

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Requirements:

1.3 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer from the designated supplier.

1.5 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.6 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Engineer, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.

B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: SCADA Integration

1. This allowance includes coordination with the existing system integrator, Complete Controls Services (CCS), located in Egg Harbor City, NJ for SCADA integration. The Contractor shall utilize the services of CCS to integrate the proposed plant upgrades into the Township’s existing SCADA system. Costs associated with the SCADA upgrades shall be paid as a lump sum under this task.

B. Allowance No. 4: Lump-Sum Allowance: Additional Work

1. This allowance includes any unforeseen work conditions discovered during construction.

PART 4 - QUANTITY AND PAYMENT

4.1 All costs associated with the allowance items shall be paid under the respective lump-sum allowance item listed in the bid form.

END OF SECTION 012100

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 012100 "Allowances" for products selected under an allowance.
   2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size,

durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of Engineers and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Engineer will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Engineer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at the discretion of the Engineer.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.

j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
   2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Engineer through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

   1. Identification: Include the following Project identification on the schedule of values:

      a. Project name and location.

b. Owner's name.
c. Owner's Project number.
d. Name of Engineer.
e. Engineer's Project number.
f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

6. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
7. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
8. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
9. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Engineer and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Owner as determined during the preconstruction meeting.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Engineer.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 All costs associated with the allowance items shall be paid under the respective lump-sum allowance item listed in the bid form.

END OF SECTION 012900

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:
1. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at weekly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

H. Unusual Event Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
   1. Meetings: Scheduling consultant to attend all meetings related to Project progress, alleged delays, and time impact.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

   1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
   2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

      a. Securing of approvals and permits required for performance of the Work.
      b. Temporary facilities.
      c. Construction of mock-ups, prototypes and samples.
      d. Owner interfaces and furnishing of items.
      e. Interfaces with Separate Contracts.
      f. Regulatory agency approvals.
      g. Punch list.

   3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

      a. UV treatment units

      b. Onsite emergency generator

   4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
   5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   6. Commissioning Time: Include no fewer than 15 days for commissioning.
   7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
   8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. The delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. The delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use-of-premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.
    n. Commissioning.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

H. Recovery Schedule: When periodic update indicates the Work is [14] or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

I. Distribution: Distribute copies of approved schedule to Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within 30 days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.7 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for Notice of Award.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Time-lapse sequence construction photographs.
5. Final Completion construction photographs.
6. Preconstruction video recordings.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within seven (7) days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Engineer and Construction Manager.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within seven (7) days of recording.

1. Submit video recordings by uploading to web-based Project management software site. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information on web-based Project management software site:

    a. Name of Project.
    b. Name and contact information for photographer.
    c. Name of Engineer and Construction Manager.
    d. Name of Contractor.
    e. Date video recording was recorded.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.3 CONSTRUCTION PHOTOGRAPHS

A. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Construction Manager.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take a minimum of 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

B. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

C. Final Completion Construction Photographs: Take a minimum of 50 photographs after date of Substantial Completion for submission as Project Record Documents. Construction Manager will inform photographer of desired vantage points.

1.4 CONSTRUCTION VIDEO RECORDINGS

A. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Engineer or Construction Manager.

1. Flag excavation areas and construction limits before recording construction video recordings.

2. Show existing conditions adjacent to Project site before starting the Work.
3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.
4. Show protection efforts by Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
4. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
5. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
7. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

3. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Engineer’s final release or approval.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Engineer.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Engineer.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Engineer by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Engineer.

    a. Engineer will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

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

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer’s receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 14 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

C. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

E. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

F. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
3. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
4. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
5. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

G. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed

before installation of product, for compliance with performance requirements in the Contract Documents.

5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

    1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

    1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 ENGINEER’S REVIEW

A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required and return.

    1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action.

B. Informational Submittals: Engineer will review each submittal and will not return it or will return it if it does not comply with requirements. Engineer will forward each submittal to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Engineer will return without review submittals received from sources other than Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 013300

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 012100 "Allowances" for allowance for metered use of temporary utilities.

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Engineer, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste-handling procedures.
5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts with galvanized barbed-wire top strand.

B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices:

1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate the needs of Owner, Engineer and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep the office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 8 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work and minimum disturbance of existing site. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service:

1. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service:

1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

a. Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Utilize designated area within existing building for temporary field offices.
2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Storage and Staging: Use designated areas of Project site for storage and staging needs.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs, so they are legible at all times.

H. Waste Disposal Facilities:

1. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control:

1. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, in accordance with erosion- and sedimentation-control drawings

    a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
    b. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
    c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during Project.
    d. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection:

1. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting the number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Engineer.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes: General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, support facilities, temporary site fencing, and, if applicable, temporary erosion and sedimentation controls if not specified in Section 311000 "Site Clearing".
2. Section 311000 "Site Clearing" for removing existing trees and shrubs and for temporary erosion- and sedimentation-control measures if not specified in Section 015000 "Temporary Facilities and Controls".

1.2 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

C. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 ACTION SUBMITTALS

A. Product Data:

1. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction

B. Shop Drawings:

1. Include plans, elevations, and sections showing trees and plants to be protected, locations of protection-zone fencing and signage, and the relationship between equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of utility boring and trenching by hand or with air spade within protection zones.

C. Tree-Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

D. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

E. Mitigation Requirements: As required by jurisdiction or as developed by arborist, for mitigation of damage to trees and other plantings. Include the following:

1. Local ordinances governing tree mitigation.
2. Standards established under the approved tree mitigation report developed by the arborist.
3. "Digital Guide for Plant Appraisal" by Council of Tree and Landscape Appraisers.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction in accordance with recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

E. Quality-control program.

1.5 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. Take precautions to protect plants from airborne contaminants, such as paint or fireproofing overspray.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of 2 parts stockpiled soil to 1 part planting soil.

B. Retain one or more of "Chain-Link Protection-Zone Fencing," "Plywood Protection-Zone Fencing," "Wood Protection-Zone Fencing," and "Plastic Protection-Zone Fencing" subparagraphs below for protection-zone fencing. Fence materials are listed in order of strongest to weakest. Retain stronger fencing where damage potential to an individual tree, group of trees, or plantings is higher. Revise post and rail diameters to suit fence height and strength required. The more expensive polymer coating may have better appearance but may be less visible to workers.

1. Chain-Link Protection-Zone Fencing: Polymer-coated galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts with 0.177-inch- diameter top tension wire and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 72 inches
b. Polymer-Coating Color: Dark green

2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

- Height: 48 inches.

a. Color: High-visibility orange, nonfading.

3. Gates: Double-swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE PROTECTION

A. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.
2. Install temporary root-protection matting over mulch to the extent indicated.

B. Trunk Protection: Protect the trunk of each tree to remain as follows:

1. Wrap trunk with orange plastic construction fencing to 2 inches thickness. Install 2-by-4-inch wood planks around trunk over wrap at maximum 3 inches apart. Minimum three planks per tree. Band together with no less than three steel bands stapled to the planks to hold them securely in place.

    a. Height: 48 inches
    b. Trunk protection to remain in place no longer than six months. If construction exceeds timeframe indicated, inspect trunk protection at six-month intervals and loosen if necessary.

3.4 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Engineer.
3. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Engineer. Install one sign spaced approximately every 50 ft on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain hydration of plants to assure plant survival.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Engineer and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.5 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones in accordance with requirements in Section 312317 "Trenching Excavation and Backfill" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.6 ROOT PRUNING

1. Cut Ends: Do not paint cut root ends.
2. Temporarily support and protect roots from damage until they are permanently covered with soil.
3. Cover exposed roots with burlap and water regularly.

B. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use

narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

C. Unless otherwise directed by arborist and acceptable to Engineer, do not cut tree leaders.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Do not paint or apply sealants to wounds.

F. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Engineer.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Engineer.

B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Engineer determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
2. Large Trees: Provide one new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6-inch in caliper size.

    a. Species: As selected by Engineer.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 012100 "Allowances" for products selected under an allowance.
   2. Section 012500 "Substitution Procedures" for requests for substitutions.
   3. Section 017700 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
   3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

   1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Submit additional documentation required by in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Engineer, whose determination is final.

B. Product Selection Procedures:

1. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

2. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Engineer's sample," provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following

conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of Engineers and owners, if requested.
5. Samples, if requested.

B. Engineer's Action on Comparable Products Submittal: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Engineer will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

1. Engineer's Approval of Submittal: Marked with approval notation from Engineer's action stamp. See Section 013300 "Submittal Procedures."
2. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 016000

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work.

C. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees that are avoided.
7. Handling and transportation costs. Include cost of collection containers for each type of waste.
8. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

3.3 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

G. Conduit: Reduce conduit to straight lengths and store by material and size.

H. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

D. Paint: Seal containers and store by type.

3.5 DISPOSAL OF WASTE.

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Engineer's use prior to Engineer's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Engineer.
d. Name of Contractor.
e. Page number.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
i. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

j. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
k. Clean strainers.
l. Leave Project clean and ready for occupancy.

B. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by email to Engineer.

2. Submit three paper copies to Owner.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.

1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Engineer.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name on table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name on manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.
    1) Submit PDF electronic files of scanned record prints and one set of file prints.
    2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
    1) Submit PDF electronic files of scanned Record Prints and three sets of file prints.
    2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order.
k. Details not on the original Contract Drawings.
l. Field records for variable and concealed conditions.
m. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.

4. Engineer will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    a. Engineer will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Engineer.
    e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Engineer.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. Transcript:
a. Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links

to corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Engineer.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning.
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
    1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the work associated with this section.

END OF SECTION 017900

SECTION 020700

NEW JERSEY ENVIRONMENTAL INFRASTRUCTURE BANK
ENVIRONMENTAL AND CULTURAL RESOURCE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. These specifications which spell out the environmental and cultural resource protection/restoration shall have precedence over the other contradictory language contained elsewhere in the design contract documents. In instances where the provisions of a Department-issued permit contradict a provision of the specifications (including those identified in Environmental Assessment Requirements for State Assisted Environmental Infrastructure Facilities, N.J.A.C. 7:22-10), the environmental resources protection and/or restoration and cultural resource mitigation measures identified in the Department-issued permit shall govern.

All activities which are part of the comprehensive environmental infrastructure project(s) for the planning area must conform to the requirements of this section regardless of the eligibility of individual components of the project.

PART 2 – PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 SUPPLEMENTARY NOTES

A. Erosion and Sediment Control
Every effort shall be made to prevent and correct problems associated with erosion and sedimentation which could occur during and after project construction. At a minimum, the following erosion and sedimentation control measures shall be followed:

1) All erosion and sedimentation control measures shall be in place prior to any grading operations or construction of proposed facilities and shall be maintained until construction is complete and the construction area is stabilized. After restoration is complete, temporary control measures shall be removed and disposed of properly.

2) All erosion and sedimentation control measures shall be constructed and maintained in accordance with the "Standards for Soil Erosion and Sediment Control in New Jersey," prepared by the New Jersey State Soil Conservation Committee," 1999, incorporated herein by reference, as amended and supplemented. Copies of the "Standards for Soil Erosion and Sediment Control in New Jersey" are available for a fee from the New Jersey Department of Agriculture, Soil Conservation Committee, or from the office of any of the 16 local conservation districts.

3) Disturbed areas that will be exposed in excess of 10 days shall be temporarily seeded and/or mulched until proper weather conditions exist for establishment of a permanent vegetative cover.

B. Site and Access Clearing

Site and access clearing must be confined to approved construction areas. Protection of existing vegetation must be practiced wherever possible. At a minimum, site access and clearing measures shall conform to the following:

1) Temporary and permanent easement widths must be reduced to the minimum feasible for the proposed construction. Unless specifically approved by the Department, permanent access roads must not be more than eight feet wide, and there shall be no permanent access roads in environmentally critical areas. Access roads may be paved only where absolutely necessary, as determined by the Department.

2) Only those portions of the site which are absolutely necessary and essential for construction shall be cleared. Whenever possible, excavation shall include the removal and storage of topsoil from the site for future use. The length of time of ground disturbance shall be reduced to the minimum practicable, especially in environmentally critical areas. Ground disturbance shall be avoided until immediately preceding construction to minimize exposure of soils.

3) Trees and shrubs within construction easements, which are not required to be removed to permit construction, shall be protected to the drip line with appropriate protection measures such as snow fencing or batter boards. Trees and shrubs whose removal is necessary to facilitate construction shall either be replanted at the same location or replaced with nursery stock of the same kind. Trees of greater than 12 inches in diameter should be preserved whenever possible by implementing slight shifts in alignment or tunneling under tree roots. Specimen trees, as identified in "New Jersey's Big Trees" 1998) published by the Department's Division of Parks and Forestry listing specimen trees in the State, shall be preserved.

4) In heavily wooded areas, every effort shall be made to avoid the destruction of common native trees and shrubs so as not to unduly disturb the ecological balance or environmental quality of the area. Trees of 12 inch diameter or greater should be preserved whenever possible and protected to the drip line. Where practical, common native trees and shrubs, of one through three-inch caliper, which must be cleared from the construction area, shall be stockpiled for use in restoration. Straggling roots shall be pruned. Trees which must be pruned to facilitate construction shall be cut cleanly and painted with tree paint. If a tree not intended to be removed is damaged, the wood shall be repaired according to common nursery practice and painted with tree paint.

C. Restoration Measures

The aim of restoration is to restore the disturbed area to a condition as nearly equal to pre-disturbance condition as possible. At a minimum, restoration measures shall conform to the following:

1) Final restoration shall be undertaken as soon as an area is no longer needed for construction, stockpiling or access. Excavated material unsuitable for backfill as set forth at N.J.A.C. 7:14-2.13 and considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be removed from the construction site and disposed of at a sanitary landfill approved and licensed by the Department. Excess excavated material which is not considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be graded or removed in accordance with N.J.A.C. 7:22-10.11(1)3. When access roads are no longer needed, road

fill shall be removed and the access area shall be-restored to predisturbance conditions. Care should be taken to avoid damage to adjacent vegetation and to prevent the formation of depressions that would serve as mosquito pools.

2) Topsoil shall be replaced with adequate amounts of topsoil material to restore the disturbed area to its original, predisturbance grade and depth of topsoil.

3) Rates and types of fertilization, liming, and seeding shall be as recommended by the local Soil Conservation District based on soil tests and local conditions. Seed mixtures shall be selected that are best suited for the particular site conditions, Seed selection shall provide for a quickly germinating initial growth, to prevent erosion, and for a secondary growth that will survive without continuing maintenance. Mulching shall occur immediately after seeding and in no case shall more than five days elapse between seeding and mulching.

4) In wooded areas, for a 50-foot wide construction easement, generally 10 trees should be planted for every 100 feet of length of the easement. More trees would be required in wider easements or densely wooded areas. Plans shall include a restoration schedule specifying the quantity, common and botanic names, sizes, and spacing of trees to be planted and the type of seed mixtures to be used from station to station. Trees to be replaced should be trees native to New Jersey suitable for the particular site and generally should conform to the list of trees found in the "Standards for Soil Erosion and Sediment Control in New Jersey," prepared by the New Jersey State Soil Conservation Committee, 1999, incorporated herein by reference, as amended and supplemented.

5) In landscaped areas, environmental features shall be replaced or restored to pre-disturbance condition or better. This includes sodding, replacement of trees and shrubs, fences, drives, and other landscape features in kind.

D. Prohibited Construction Procedures

Prohibited construction procedures include, but are not limited to, the following:

1) Dumping of spoil material into any stream corridor, any wetlands, any vernal habitats, any surface waters, any sites listed or eligible for listing on the New Jersey or National Registers of Historic Places, or at unspecified locations;

2) Indiscriminate, arbitrary or capricious operation of equipment in any stream corridors, wetlands, vernal habitats or surface waters;

3) Pumping of silt-laden water from trenches or other excavations into any surface waters, stream corridors, wetlands, or vernal habitats;

4) Damaging vegetation adjacent to or outside of the access road or the right-of-way;

5) Disposal of trees, brush and other debris in any stream corridors, wetlands, vernal habitats, surface waters, or at unspecified locations;

6) Permanent or unspecified alteration of the flow fine of any stream.

7) Open burning of project debris.

8) Use of calcium chloride, petroleum products or other chemicals for dust control; and

9) Use of asphaltic mulch binders; and

10) Any unpermitted discharge of sewage.

E. Wetlands

Construction in wetlands shall conform to requirements of the New Jersey Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et. seq., and N.J.A.C. 7:7A.

F. Stream Crossings

Stream crossings shall conform to the requirements of the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et. seq., and N.J.A.C. 7:13.

G. Steep Slopes

Slopes exceeding 15 percent require special treatment. Measures such as water diversion berms, sodding, or the use of jute or excelsior blankets should be used as appropriate. Hay bales shall be placed at the base of the slope prior to ground disturbance. Steep slopes that have been disturbed, if not sodded, shall be seeded and mulched immediately after construction is complete. Slope boards or other measures necessary to prevent slumping of the disturbed slope shall be incorporated, where appropriate.

H. Acid Producing Soils

If there is a possibility of encountering acid-producing deposits in the course of construction, as identified during the planning process, the following special requirements and conditions will apply:

1) In vegetated areas, the top two feet of soil shall be stripped and stockpiled separately from the material to be excavated. A soil specialist, to be provided by the project sponsor, shall monitor the stripping operation. If any acid-producing deposits are identified, this material and any contaminated soil shall be disposed of on the same day. The presence of acid-producing deposits is detected by the use of the following tests:
    a. Determining the pH of the soil when suspended in 0.5 Molar calcium chloride solution (of neutral pH). A pH value below 3.0 indicates presence-of ferrous sulfate and presence of acid-producing deposits is strongly suspected.

    b. Test for sulfate by adding a drop of 10 percent barium chloride solution to a water extract of the material. If voluminous flocks of barium sulfate form immediately the presence of acid-producing deposits is strongly suspected.

2) The disposal site shall be approved by the Department. Any soil of this type disposed of shall be covered with a minimum of two feet of cover to prevent rapid oxidation and subsequent acid formation.

3) In both vegetated and paved areas, when acid-producing deposits are encountered, as determined by the soil specialist, excavated trench material shall be returned to the trench as follows:

    a. Lower material first, followed by upper material.

b. The top one to two inches of soil on which the deeper soil was stockpiled shall be scraped and placed below a depth of two feet.

c. For pipeline construction, the quantity of material to be displaced by bedding and pipe, as well as soil scraped from the stockpile area, shall be subtracted from the deeper, excavated material and this quantity of deeper material removed to an approved disposal site and covered as described in the "Restoration Measures."

d. After backfilling the deeper soil, one ton of limestone per 2,000 square feet shall be spread over the deeper soil in the trench. This liming requirement is applicable in areas of well drained, nonsaturated soils, as determined by the soil specialist.

e. In vegetated areas, the top two feet of soil, stockpiled for this purpose, shall then be replaced. If the top two feet of soil was also contaminated, clean backfill material similar to the native topsoil shall be used in place of the contaminated material.

4) The excavated acid-producing deposits shall not be exposed for a period longer than eight hours. When acid-producing deposits are encountered, the trench opened in any construction day shall be backfilled and the areas cleaned up by the close of the day. Where this is impracticable, such as in the construction of pumping stations and treatment plants, exposed acid-producing deposits shall be covered with limestone screenings at a rate of 100 tons per acre and then covered with six inches of compacted soil within one week of exposure or before the exposed soil drops to pH 3, whichever occurs first. The pH shall be monitored daily under this procedure.

5) Temporary restoration of vegetated areas shall consist of mulching and shall be put in place at the end of each day's construction. Permanent restoration of the area shall begin as soon as construction is complete and after the results of incubation tests, where necessary, are available.

6) Prior to restoring vegetated areas, the soil specialist shall perform pH tests on the in-situ soil after the construction is completed. If the pH is below 4, intensive liming shall be required in order to make the soil suitable for plant survival.

7) Lime requirement tests shall be performed by the soil specialist to determine the lime application rates. This will require an incubation test in which the sample is oxidized for a period of six weeks, as follows:

   a. The sample shall be air dried and ground so that the whole sample passes a 0.5-millimeter sieve.

   b. The lime requirement to reach pH 6.5 shall be determined initially and again at two-week intervals for six weeks, using standard soil testing techniques.

   c. The total lime requirement determined by this method can be extrapolated to the area under consideration.

8) At a minimum of 30 tons of limestone per acre or the amount of lime required according to the incubation test result shall be applied prior to seeding and planting where the pH is

less than 4. Where the pH is greater than 4, liming and fertilizing requirements set out in the planting and environmental specifications shall apply.

9) The spreading and mixing of the subsoil and any topsoil contaminated with acid-producing deposits around the site and beyond the site is prohibited. Areas used for stockpiling acid-producing deposits shall be minimized. Equipment used for excavation and backfilling shall be cleaned, to the extent practicable, at the end of each day's operation and the soil removed shall be placed in the trench below a depth of two feet. No construction shall take place during significant rainstorms or while the area is saturated to avoid smearing or spreading of the acid-producing deposits over the area

I. Dewatering

When dewatering will occur and a dewatering permit is not required, the contractor shall monitor for adverse effects to structures or wells due to dewatering and shall be responsible to remedy same to the satisfaction of the Department. Discharges from dewatering activities which contain silt are subject to the following controls:

1) All discharges from dewatering activities to surface waters, wetlands, vernal habitats, or storm sewers shall be free of sediment. Care shall be taken not to damage or kill vegetation by excessive watering or by damaging silt accumulation in the discharge area. If discharges are sediment laden, techniques shall be employed to remove sediment prior to discharge. A sedimentation basin shall be constructed and used as specified, where necessary, to protect vegetation and to achieve environmental objectives.

2) Sewer inlets within construction areas shall be provided with perimeter hay bales or other appropriate siltation control measures.

J. Stockpile, Storage and Disposal

Requirements with regard to the location and control of stockpile, storage and disposal areas, whether provided by the project sponsor or the contractor, must conform to the following:

1) Only environmentally suitable stockpile sites may be used for the purposes of staging or storing materials, equipment and suitable trench backfill material. Environmentally suitable sites must be level, and devoid of mature stands of natural vegetation. Drainage facilities and features, wetlands, vernal habitats, and stream corridors are not environmentally suitable sites.

2) The boundary of the stockpile area shall be clearly marked by hay bales, silt fencing or another appropriate method. Where fill is to be stored in excess of 10 days, a suitable means of protecting excavated material from wind and water erosion shall be employed. Erosion control methods may include one or more of the following: mulching, sprinkling, silt fencing, haybaling and stone covering.

3) Excess excavated material which is not considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be graded on-site only to the extent needed to achieve pre-construction grade, unless otherwise specifically approved by the Department. The project sponsor shall ensure that the contractor removes the remainder from the site and disposes of it at a site approved by the project sponsor in accordance with the following:

a. Disposal sites selected by the contractor shall be evaluated and approved by the project sponsor prior to their use. Disposal sites may also be selected by the project sponsor. The project sponsor shall conduct periodic inspection of disposal sites to ensure compliance with the requirements of this subsection during the off-site disposal operation.

b. The disposal of excess excavated material in wetlands, vernal habitats, stream corridors and floodplains is strictly prohibited, even if the permission of the property owner is obtained. The contractor shall be responsible to remove any fill improperly placed by the contractor at the contractor's expense and restore the area impacted.

c. If excess excavated material is placed on private property, a hold harmless release in favor of the project sponsor and the Department shall be obtained from the property owner.

d. Prior to approval of a site for excess excavated material disposal, where the site exceeds 5,000 square feet, the project sponsor shall obtain, or shall ensure that the contractor or property owner has obtained, the appropriate certification of the soil erosion and sediment control plan in accordance with the State's standards for soil conservation (N.J.S.A. 4:24-1 et seq., also referred to as Chapter 251). Where the site is less than 5,000 square feet, the project sponsor shall advise the property owner of the need for erosion and sediment control and obtain a statement that the property owner accepts complete responsibility for implementation of appropriate methods to prevent erosion and sedimentation.

K. Dust Control

In order to control dust, as often as required during each working day, and particularly prior to the conclusion of each working day areas under immediate construction (including access roads and other areas affected thereby) shall be swept and wet down with water sufficiently to lay dust. In addition, these areas shall be wet down during non-working hours (including weekends) as often as required to keep the dust under control. The use of calcium chloride or petroleum products or other chemicals for dust control is prohibited.

L. Noise

In order to limit noise impacts in the vicinity of sensitive receptors, construction operations and activities shall be limited as follows: Monday through Friday between the hours of 7:00 A.M. and 6:00 P.M. unless variances to these times are granted in times of emergency. No driving, pulling, or other operations entailing the use of vibratory hammers or compactors shall be permitted, other than between the hours of 8:00 A.M. and 5:00 P.M. The number of machines in operation at a given time shall be limited to the minimum practicable. All engine generators or pumps must have mufflers and be enclosed within a temporary structure.

M. Cultural Resource Requirements

1) If a cultural resource is encountered during the course of construction, the Contractor is directed to halt all construction activities in that area. The Contractor shall immediately contact the Project Sponsor who shall contact the Department. The Department will determine and require initiation of the appropriate actions in conformance with N.J.A.C. 7:22-10.8.

2) The Contractor shall not dispose of excess excavated material at, stockpile construction materials at, or obtain borrow material from, properties which are listed or eligible for listing on the New Jersey or National Registers of Historic Places.

3) If unexpected archaeological resources are encountered during construction, the Contractor must immediately halt all construction in the vicinity of the discovery and contact the Owner.

4) When the Owner is contacted by the Contractor in accordance with the above provisions, the Owner must immediately contact NJDEP-Municipal Finance and Construction-Technical Services at (609) 292-8961 or (609) 633-1170. The Bureau of Program Development & Technical Services will determine the appropriate actions, in accordance with N.J.A.C. 7:22-10.8, and the Federal Advisory Council on Historic Preservation procedures.

N. Construction Phase Requirements

The project sponsor will employ one, or more if warranted by the scope of the project, environmental inspector(s) to ensure that the requirements of the specifications relating to environmental and cultural resource protection and restoration are effectively carried out. Individuals designated as environmental inspectors by the project sponsor must possess, at a minimum, the education/experience qualifications of an Environmental Specialist employed with the Department. The Department will also conduct environmental inspection to oversee the conduct of the protection/restoration measures. Responsibilities of the project sponsor's environmental inspector(s) include the following:

1) Daily inspections of active work areas and periodic inspection of maintenance or restoration areas sufficient to ensure performance of protection measures in accordance with contract documents.

2) The maintenance of a daily job diary in which they shall record the progress of the work and of any problems encountered. The environmental inspectors shall notify the Contractor in writing immediately upon noticing that environmental specifications are not being met.

3) At frequent intervals during construction, the recipient, the resident engineer, the environmental inspectors and the Department inspectors shall meet to review progress and to resolve difficulties that might result in unnecessary delays in the work. The Department shall notify the recipient if deficiencies are not immediately corrected. The recipient shall then direct compliance with the environmental requirements.

O. Environmental Maintenance Bond

The project sponsor shall require that the contractor supply an environmental maintenance bond in the amount of $25,000 or 50 percent of the price bid for the materials needed to fulfill the environmental specifications, whichever is greater. The environmental maintenance bond shall provide that the contractor shall remedy, without cost, any defects which result from faulty workmanship, or from failure to comply with the specifications and which develop during the period of one year from the expiration of the performance bond, required pursuant to N.J.S.A. 40A:11-22.

P. Photographs

The project sponsor shall obtain photographs of existing conditions prior to the start of site and access clearing and construction. At a minimum, one 8-inch by 10-inch color glossy print photograph shall be obtained for each 100 feet of the construction area. Special attention shall be given to environmentally critical areas and areas outside of the public right-of-way. Photographs shall be labeled by station so that upon completion of the construction, or during construction if necessary, subsequent photographs can be taken from the same control points. The project sponsor shall file copies of the above photographs with the Department. As a supplement to the required photographs, video documentation may be submitted to the Department, as is encourages as a way of documenting site conditions.

PART 4 – MEASUREMENT, QUANTITY & PAYMENT

4.1 PAYMENT

A. Payment for Environmental and Cultural Resource Protection, including down time and brief delays in construction and environmental and cultural resource protection/restoration measures, shall be included under Bid Item, "Environmental and Cultural Resource Protection and Restoration" in a lump sum price. No separate payment shall be made for any accessories not listed in these specifications as required for complete traffic control through the duration of the project.

END OF SECTION 020700

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:
1. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

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

B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

C. Unless otherwise indicated, demolition waste becomes property of Contractor.

D. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, for dust control, for noise control. Indicate proposed locations and construction of barriers.

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

B. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

C. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.4 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.5 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
2. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place. Existing chlorine contact tank to be abandoned in place.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at

perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove: Concrete pads, concrete retaining wall and foundation, chlorine contact tank and connecting pipes and fittings, terracotta sewer line, as shown in drawings.

PART 4 - QUANTITY AND PAYMENT

4.1 All costs associated with Demolition shall be included under the lump sum bid item “SITE DEMOLITION COMPLETE” as listed in the bid form including but not limited to abandonment in place of existing chlorine contact tank and piping connected to the tank and to the hydrants, removal and disposal of the hydrants, removal and disposal of lime and Klenphos-300 tanks, connecting equipment, chemical feed system, demolition of existing retaining wall, and concrete pad as shown on the plans.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

b. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.

9. Color pigments.
10. Fiber reinforcement.
11. Vapor retarders.
12. Floor and slab treatments.
13. Liquid floor treatments.
14. Curing materials.

a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

15. Joint fillers.
16. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.
11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Engineer.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures:

    a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, incorporating permeability-reducing admixtures.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality-Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Permeability.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I Type II,.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
7. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.

8. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 6 mils thick.

2.4 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

2.5 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.6 CURING MATERIALS

A. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ChemMasters, Inc.
b. Concrete Sealers USA.
c. Kaufman Products, Inc.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
4. Use permeability-reducing admixture in concrete mixtures where indicated.

D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: .48
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:

a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

B. Class B: Normal-weight concrete used for foundation walls.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:

a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior slabs-on-ground.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:

a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

A. Comply with ACI 117.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.5 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.

6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Engineer.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.
    e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish.

3. ACI 301 Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/8 inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class A.
e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply the following to as cast surface finishes wherever these type of surfaces are shown on the Drawings:

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
d. Maintain required patterns or variances as shown on Drawings.

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
b. Do not clean concrete surfaces as Work progresses.
c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
f. Maintain required patterns or variances as shown on Drawings.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.
        2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
        3) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.
        4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.
        5) Specified overall values of flatness, F_F 50; and of levelness, F_L 25; with minimum local values of flatness, F_F 40; and of levelness, F_L 17.

    b. Suspended Slabs:

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
3) Specified overall values of flatness, F_F 35; and of levelness, F_L 20; with minimum local values of flatness, F_F 24; and of levelness, F_L 15.
4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings and/or where ceramic or quarry tile is to be installed by either thickset or thin set method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Engineer before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Engineer before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications.
b. Tamp aggregate flush with surface, but do not force below surface.
c. After broadcasting and tamping, apply float finish.
d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces in accordance with manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
4. After final floating, apply a trowel finish.
5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.11 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.

2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

g. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.13 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
3. Rinse with water; remove excess material until surface is dry.
4. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
   1. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

   1. Repair and patch defective areas when approved by Engineer.
   2. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

      a. Limit cut depth to 3/4 inch.
      b. Make edges of cuts perpendicular to concrete surface.
      c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
      d. Fill and compact with patching mortar before bonding agent has dried.
      e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

      a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
      b. Compact mortar in place and strike off slightly higher than surrounding surface.

   3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.

c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. The scheduling and costs for all testing shall be the responsibility of the contractor.
1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Engineer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

b. Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.

       1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Engineer.

3.17 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.

3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all excavation, shoring, formwork, finishes, steel reinforcement, reinforcement accessories, concrete materials, admixtures, water stops, vapor barriers, treatments, curing materials, joint fillers, bonding agents, adhesives, repair materials, testing, and all related appurtenances as required per the contract documents.

END OF SECTION 033000

SECTION 048100 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions of the Contract, as applicable.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Masonry-cell insulation.

B. Products installed, but not furnished, under this Section include the following:
1. Steel lintels for unit masonry, furnished under Misc. Metals
2. Hollow-metal frames in unit masonry openings, furnished under Steel Doors and Frames.

1.3 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Shop Drawings: Show fabrication and installation details for the following:
1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:

1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
2. Colored mortar Samples showing the full range of colors available.

D. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project.
3. Weep holes/vents in color to match mortar color.
4. Accessories embedded in the masonry.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.
   a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each material and grade indicated for reinforcing bars.
4. Each type and size of joint reinforcement.
5. Each type and size of anchor, tie, and metal accessory.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Sample Panels: Before installing unit masonry, build sample panels, using materials indicated for the completed Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels for each type of exposed unit masonry assembly in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.

1. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
2. Clean exposed faces of panels with masonry cleaner indicated.
3. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Architect in writing.

7. Demolish and remove sample panels when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

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

B. Concrete Masonry Units: ASTM C90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa)
2. Weight Classification: Normal weight.
3. Provide Type I, moisture-controlled units.
4. Size (Width): Manufactured to the following dimensions as indicated on the plans:

    a. 4 inches (102 mm) nominal; 3-5/8 inches (92 mm) actual.
    b. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
    c. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.

5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

C. Decorative Concrete Masonry Units: ASTM C90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa.
2. Weight Classification: Normal weight.
3. Provide Type I, moisture-controlled units.
4. Size: Manufactured to dimensions indicated for nondecorative units.
5. Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples.
    a. Normal-weight aggregate, split-face finish.

6. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.

    a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    b. Products: Subject to compliance with requirements, provide one of the following:

        1) Block Plus W-10; Addiment Inc.
        2) Dry-Block; W. R. Grace & Co., Construction Products Division.
        3) Rheopel; Master Builders.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

B. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

1. White-Mortar Aggregates: Natural white sand or ground white stone.
2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

C. Aggregate for Grout: ASTM C 404.

D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

F. Water: Potable.

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

1. Colored Portland Cement-Lime Mix:

    a. Eaglebond; Blue Circle Cement.
    b. Color Mortar Blend; Glen-Gery Corporation.
    c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
    d. Centurion Colorbond PL; Lafarge Corporation.
    e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
    f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

2. Cold-Weather Admixture:

    a. Accelguard 80; Euclid Chemical Co.
    b. Morseled; W. R. Grace & Co., Construction Products Division.
    c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.

3. Water-Repellent Admixture:

    a. Mortar Tite; Addiment Inc.
    b. Dry-Block Mortar Admixture; W. R. Grace & Co., Construction Products Division.
    c. Rheopel; Master Builders.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; Grade 60.

2.4 MASONRY JOINT REINFORCEMENT

A. General: ASTM A951 and as follows:
    1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
    2. Wire Size for Side Rods: W1.7 or 0.148 inch (3.8 mm).
    3. Wire Size for Cross Rods: W1.7 or 0.148 inch (3.8 mm).
    4. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

C. For multiwythe masonry, provide types as follows:

    1. Ladder type with perpendicular cross rods spaced not more than 16 inches (407 mm) o.c. and 1 side rod for each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod for each wythe of masonry 4 inches (100 mm) or less in width.
    2. Tab type with single pair of side rods spaced for embedment within each face shell of backup wythe and rectangular box-type cross ties spaced not more than 16 inches (407 mm) o.c. Size ties to extend at least halfway through outer wythe but with at least 5/8-inch (16-mm) cover on outside face.

2.5 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.6 BENT WIRE TIES

A. General: Rectangular units with closed ends and not less than 4 inches (100 mm) wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches (32 mm).

B. Wire: Fabricate from 3/16 inch (4.8 mm) diameter, hot-dip galvanized steel wire.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire anchor section for welding to steel.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.1875 inch (4.8 mm) diameter, hot-dip galvanized steel wire.

2.8 ADJUSTABLE MASONRY-VENEER ANCHORS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

B. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:

1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.

2. Anchor Section: Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.

    a. Plate 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long with strap 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch (0.8 mm).
3. Wire Tie Section: Triangular or Rectangular shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
4. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0966 inch (2.5 mm)**,** thisck, steel sheet, galvanized after fabrication.
5. Fabricate wire tie sections from 0.1875 inch (4.8 mm) diameter, hot-dip galvanized steel wire.

C. Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:

1. Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

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

1. Screw-Attached, Masonry-Veneer Anchors:

    a. D/A 213; Dur-O-Wal, Inc.
    b. D/A 210 with D/A 700-708; Dur-O-Wal, Inc.
    c. 315-D with 316; Heckman Building Products, Inc.
    d. Pos-I-Tie; Heckman Building Products, Inc.
    e. DW-10; Hohmann & Barnard, Inc.
    f. DW-10HS; Hohmann & Barnard, Inc.
    g. DW-10-X; Hohmann & Barnard, Inc.
    h. 1004, Type III; Masonry Reinforcing Corporation of America.
    i. RJ-711; Masonry Reinforcing Corporation of America.

2. Organic-Polymer-Coated, Steel Drill Screws:

    a. Dril-Flex; Elco Industries, Inc.
    b. Traxx; ITW-Buildex.

2.9 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.

2. Nonheaded bolts, bent in manner indicated.

B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Type: Expansion anchors.
   2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
   3. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.10 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:

B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

   1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

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

D. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.

E. Wicking Material: Cotton or polyester rope, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.

F. Plastic Weep Hole/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, designed to fill head joint with outside face held back 1/8 inch (3 mm) from exterior face of masonry, in color selected from manufacturer's standard.

G. Cavity Drainage Material: ¾ inch (19 mm) thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

H. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 inch (3.6 mm) steel wire, hot-dip galvanized after fabrication.

1. Provide units with either two loops or four loops as needed for number of bars indicated.

I. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:

1. Plastic Weep Hole/Vent:

a. Cell Vent; Dur-O-Wal, Inc.

2. Cavity Drainage Material:

a. Mortar Break; Advanced Building Products, Inc.
b. CavClear Masonry Mat; CavClear.
c. Mortar Net; Mortar Net USA, Ltd.
d. Mortar Stop; Polytite Manufacturing Corp.

3. Reinforcing Bar Positioners:

a. D/A 811; Dur-O-Wal, Inc.
b. No. 376 Rebar Positioner; Heckman Building Products, Inc.
c. #RB Rebar Positioner; Hohmann & Barnard, Inc.
d. O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.

2.12 MASONRY-CELL INSULATION

A. Molded-Polystyrene Insulation Units: 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. Provide cell insulation in units as located in the architectural plans or specifications.

2.13 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.14 MORTAR AND GROUT MIXES

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

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification.
   1. For masonry below grade, in contact with earth, and where indicated, use Type S.
   2. For reinforced masonry and where indicated, use Type S.

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

   1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond. Clean exposed surfaces of set masonry and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout for full height of wall under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

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

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 BONDING OF MULTIWYTHE MASONRY

A. Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.

B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
   1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

   1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

3.8 MASONRY-CELL INSULATION

A. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.9 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

   1. Space reinforcement not more than 16 inches (406 mm) o.c.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

   1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
   2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 16 inches (610 mm) o.c. vertically and 32 inches (915 mm) o.c. horizontally.

3.11 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.
2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 32 inches (813 mm) o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.12 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry as follows unless otherwise indicated on drawings. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
1. Vertical control joins shall be spaced at maximum 20’-0” o.c. in any continuous run of wall.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

3.13 LINTELS

A. Install steel lintels where indicated or as required to provide support above all openings as shown on the architectural, structural, mechanical, plumbing or electrical plans.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
1. Provide prefabricated or built-in-place masonry lintels if required in the architectural plans. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

D. Fill cores in hollow concrete masonry units with grout for full height of wall under all lintels.

3.14 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C. Install flashing as follows:
   1. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier or building paper.
   2. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn flashing up not less than 2 inches (50 mm) to form a pan.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

   1. Use round plastic tubing, wicking material or plastic weep hole/vents to form weep holes.
   2. Use wicking material to form weep holes above flashing in brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
   3. Space weep holes formed from plastic tubing or wicking material 16 inches (400 mm) o.c.
   4. Place cavity drainage material immediately above flashing in cavities.

E. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

F. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.15 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

   1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.16 PARGING

A. Parge predampened masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Scarify first parge coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect the parging until cured.

3.17 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

3.18 MASONRY WASTE DISPOSAL

A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all excavation, shoring, finishes, steel reinforcement, reinforcement accessories, materials, vapor barriers, admixtures, curing materials, joint fillers, bonding agents, adhesives, repair materials, testing, and all related appurtenances as required per the contract documents.

END OF SECTION 048100

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.
3. Prefabricated building columns.
4. Shear stud connectors.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 099113 "Exterior Painting" and/or Section 099123 "Interior Painting" for painting requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

E. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.

a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
b. Use Load and Resistance Factor Design; data are given at factored-load level.

2. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Load and Resistance Factor Design; data are given at factored-load level.

C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M

B. Channels, Angles, M-Shapes, S-Shapes: ASTM A36/A36M

C. Plate and Bar: ASTM A36/A36M Retain "Corrosion-Resisting (Weathering) Structural-Steel Shapes, Plates, and Bars" Paragraph below for corrosion-resisting (weathering) structural steel and indicate locations on Drawings.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

1. Weight Class: Standard.
2. Finish: Black except where indicated to be galvanized.

F. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.

G. Steel Forgings: ASTM A668/A668M.

H. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1 (Type 10.9-1), compressible-washer type with plain finish.

C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating.
2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with mechanically deposited zinc coating finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable (whichever specified on Drawings).

1. Configuration: Straight or Hooked.
2. Nuts: ASTM A563 (ASTM A563M) hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
5. Finish: Plain or Hot-dip zinc coating, ASTM A153/A153M, Class C.

B. Headed Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable (whichever specified on Drawings), straight.

1. Nuts: ASTM A563 (ASTM A563M) hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
4. Finish: Plain or Hot-dip zinc coating, ASTM A153/A153M, Class C.

C. Threaded Rods: ASTM A36/A36M or ASTM A572/A572M, Grade 50 (Grade 345).

1. Nuts: ASTM A63 (ASTM A563M) hex carbon steel.
2. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
3. Finish: Plain or Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 FORGED-STEEL STRUCTURAL HARDWARE

A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.

B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.

C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

2.6 SLIDE BEARINGS

A. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amscot Structural Products Corp.
b. Fluorocarbon Company Limited.
c. GRM Custom Products.
d. R.J. Watson Bridge & Structural Engineered Systems.
e. Approved Equivalent.

2. Mating Surfaces: PTFE and PTFE.

3. Coefficient of Friction: Not more than 0.05.
4. Design Load: Not less than 5,000 psi (34 MPa).
5. Total Movement Capability: 2 inches (50 mm).

2.7 PRIMER

A. Steel Primer:
   1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#26.

   1. Etching Cleaner: MPI#25, for galvanized steel.
   2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.8 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.9 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.

F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Welded-Steel Door Frames: Build up welded-steel doorframes attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated on Drawings.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.10 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.11 PREFABRICATED BUILDING COLUMNS

A. Prefabricated building columns, consisting of load-bearing structural-steel members protected by concrete fireproofing encased in an outer non-load-bearing steel shell.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Black Rock Fireproof Column, a division of United Steel.
b. Dean Lally LLC / FireTrol Columns.
c. Approved Equivalent.

B. Fire-Resistance Ratings: Provide prefabricated building column listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing in accordance with ASTM E119.

1. Fire-Resistance Rating: As indicated on Drawings.

2.12 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.13 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Corrosion-resisting (weathering) steel surfaces.
7. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7 (WAB)/NACE WAB-4.
4. SSPC-SP 14 (WAB)/NACE WAB-8.
5. SSPC-SP 11.
6. SSPC-SP 6 (WAB)/NACE WAB-3.
7. SSPC-SP 10 (WAB)/NACE WAB-2.
8. SSPC-SP 5 (WAB)/NACE WAB-1.
9. SSPC-SP 8.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.14 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.
    d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
    b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.

5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 INSTALLATION OF PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with ANSI/AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

    a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

        1) Liquid Penetrant Inspection: ASTM E165/E165M.
        2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        3) Ultrasonic Inspection: ASTM E164.
        4) Radiographic Inspection: ASTM E94/E94M.

3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
    b. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

PART 4 - MEASUREMENT, QUANITTY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all furnishment and installation of structural steel materials as required per the contract documents. This includes but is not limited to fabrication of structural steel girders and columns, all connections and anchors, priming and galvanizing as required, and erection of all structural steel.

END OF SECTION 051200

SECTION 051300 - STRUCTURAL STAINLESS-STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section covers the design, fabrication, and installation of structural stainless-steel metal framing. The structural stainless-steel is as shown on the Contract Drawings and specified herein, including, but not limited to, the following:

1. Stainless-steel structural framing shown on the Drawings.
2. Grouting of base plates, leveling and bearing plates.
3. Bolts, post-installed anchors and other accessories.

1.2 REFERENCES

A. American Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings (AISC 360).
2. Code of Standard Practice for Steel Buildings and Bridges.
3. Specification for Structural Joints Using High-Strength Bolts (approved by Research Council on Structural Connections, December 2009).
4. Steel Design Guide No. 27, Structural Stainless Steel.
5. Manual of Steel Construction, 14th Edition. C. American National Standards Institute (ANSI):

1. ANSI B18.22.1, Plain Washers.

D. American Society for Testing and Materials (ASTM):

1. ASTM A 276 "Standard Specification Stainless Steel Bars and Shapes".
2. ASTM A 320 "Standard Specification for Alloy/Steel Bolting Material for Low Temperature Service".
3. ASTM A 480 "Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plates, Sheet, and Strip".
4. ASTM A 484 "Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings".
5. ASTM A 554 "Standard Specification for Welded Stainless Steel Mechanical Tubing".
6. ASTM A 666 "Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip Plate, and Flat Bar".
7. ASTM E164, Practice for Contact Ultrasonic Testing of Weldments.
8. ASTM E709, Guide for Magnetic Particle Testing.
9. ASTM F 593 "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs".
10. ASTM F 594 "Standard Specification for Stainless Steel Nuts". E.

American Welding Society (AWS):

1. D1.6 Structural Welding Code – Stainless Steel.

F. Nickel Development Institute (NiDI).

1. NiDI “Design Manual for Structural Stainless Steel”.
2. NiDI “Welding of Stainless Steels and other Joining Methods”.

G. Research Council on Structural Connections (RCSC)

1. Specification for Structural Joints Using High-Strength Bolts

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit drawings to the Engineer showing the field verified location, elevation, and size of the existing structural concrete bearing surfaces with respect to the anticipated locations provided on the Drawings. Changes in the location of bearing points may be required to suit existing conditions as directed by the Engineer if existing conditions are excessively different than anticipated.
2. Submit shop drawings identifying the details as indicated on Drawings, indicating completely the location in the project, the size and weights of the members, the methods of joining various components, the quantity, finish, the location and type of anchors and necessary measurements.
3. Provide easy-to-read markings on shop and erection drawings for shop assemblies which require markings for erection identification.
4. Note on shop drawings variations in tolerances or clearances between various products.
5. Use standard welding symbols of the American Welding Society on shop drawings; show size, length, and type of each weld.
6. Indicate the materials used and beam marks.
7. Reference shop drawings to specific location and detail number on the Drawings.
8. Indicate location and type of special finish requirements, including grinding of welds.
9. Copies of the Contract Documents will not be considered as meeting these requirements.
10. Provisions of AISC Code of Standard Practice for Steel Buildings and Bridges related to shop and erection drawings are not applicable. Submit shop drawings to Architect and Engineer for review and obtain acceptance prior to start of fabrication.
11. Submit fabricators identification mark system prior to fabrication.

B. Working Drawings:

1. Furnish setting diagrams, templates, and directions for the installation of structural framing anchor bolts, bearing plates, and other embedded items.

C. Product Data:

1. Mill Reports:

a. Submit copies of certified mill test reports for each heat of steel and for all fasteners, including nuts and washers prior to start of fabrication.
b. Mill test reports shall include ladle analysis and tensile elongation and bend tests. Perform mechanical and chemical tests for all material regardless of thickness or use.
c. Along with mill reports submit tests results of Charpy V-notch tests when Charpy V-notch criteria is specified.
d. Mill reports shall be traceable to individual pieces of steel used.
e. In addition to other requirements, mill reports shall address the following elements: copper, columbium, chromium, nickel, molybdenum, silicone, and vanadium.
f. Provide mill reports for all welding consumables used on this project.

D. Certifications:

1. Prior to commencing work requiring welding, submit the procedure which will be used for prequalifying welders and welding procedures. For all procedures other than those set forth in AWS D1.6, submit a copy of procedure qualification test records.
2. Submit certified copy of qualification test record showing each welder, welding operator, and tacker who will be employed in the work has satisfactorily passed AWS qualification tests for welding procedures.
3. Submit certified copy of reports for all analyses and tests required by referenced ASTM Specifications, including test reports for filler metals for welding, and mechanical tests for threaded fasteners.
4. Submit reports signed by the manufacturer certifying their products comply with requirements specified.
5. Submit test reports certifying material conforms to ASTM specification.
6. Submit guarantee showing all steel used for this project is American-made.
7. Submit written affidavits from steel manufacturer indicating the percentage of post-industrial recycled content (90% min.) and post-consumer recycled content (75% min.)

E. Welding Procedure Submittals:

1. Submit written Welding Procedures Specifications (WPSs) in accordance with AWS D1.6 requirements for each different welded joint proposed for use whether prequalified or qualified by testing. The manufacturer and specific electrode shall be stated in the WPS. Manufacturer and specific electrodes shall be considered essential variables for the WPS.
2. All weld joints shall be qualified for this project even if they are pre-qualified. This qualification will be with the same electrodes, processes and procedures that will be used on this project.
3. In addition to the Welding Procedure Specifications, submit fabrication and erection procedures where needed to control shrinkage, fabrication tolerances, or to insure proper inspection.
4. Procedure Qualification Record (PQR) in accordance with AWS D1.6 for all procedures qualified by testing.

5. Electrode manufacturers' data.
6. The WPS and PQR will be reviewed by the Testing and Inspection Agency (Approved Agency) for conformance with the requirements of AWS D1.6. F. Qualification Statement:

   Submit qualification statement denoting the requirements of this specification are met by the following:
   a. Structural stainless-steel fabricator qualifications.
   b. Structural stainless-steel erector qualifications.
   c. Professional Land Surveyor.

F. An Independent Testing and Inspection Agency (Approved Agency) shall submit inspection and testing reports required by this Section. H. Post-Installed Anchors to Concrete:

1. Submit detailed procedure for installation of post-installed anchors in concrete.
2. Submit procedure for testing of post-installed anchors.
3. Submit post-installed anchor testing records.

G. Mock-up:

1. Submit a finished, mock-up sample of the following connections to Architect and Engineer for approval of weld and surface finishes prior to starting the fabrication process.
   a. One Longitudinal Beam (LB) to Secondary Transverse Beam (ST).
   b. One Longitudinal Beam (LB) to Primary Transverse Beam (PT).
   c. One Secondary Transverse Beam (ST) to Longitudinal Edge Beam (LE) welded through access cover.
2. Sample must be accompanied by a written polishing/finishing procedure specification.

1.4 QUALITY CONTROL

A. Qualifications:

1. Fabricator: Company experienced in fabricating structural steel similar to that indicated for the project who has a successful in-service performance for a minimum of 5 continuous years and sufficient production capacity.
   a. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant with Category STD at time of bid.
   b. Fabricator shall have sufficient production capacity to produce and deliver the materials on time to meet the approved construction schedule for this Contract.
2. Erector: Company experienced in erecting structural steel work similar to that indicated for the project who has a successful in-service performance with a minimum of 5 continuous years of experience.

3. Steel Fabricator and Erector shall demonstrate previous experience with similar architecturally exposed stainless-steel structures.
4. Welder, Tacker, and Welding Operator Qualifications: Use welders, tackers, and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.6 of the American Welding Society to perform type of work required.
    a. Welder qualification shall include passing the bend test and Charpy tests when Charpy values are specified for the electrode.
    b. Require welders to retake the qualification test if, as determined by the Architect, there is a reasonable doubt as to the proficiency of the welder. If the welder does not re-qualify, then the welder shall not perform any welding on the project.
    c. Pay all costs associated with welder qualification.
5. Land Surveyor: A surveyor licensed in the State of Virginia who is qualified to determine and verify the top of steel elevations and the edge of slab locations for each elevated framed level and to verify the structure is square, plumb, and level in accordance with AISC tolerances.

B. Comply with applicable provisions listed in those references stated in Section 1.2 of this specification unless otherwise indicated.

C. Owner's Testing Laboratory:

1. Shop and field-testing and inspection of steelwork specified in this document or requested by the Owner will be performed by an approved Independent Testing and Inspection Agency engaged by the Owner (Approved Agency).

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage, and handling of stainless-steel products should comply with guidelines set forth in Chapter 7 of NiDI “Design Manual for Structural Stainless Steel” and in “Stainless Steel Fabrication” published by the Specialty Steel Industry of North America.

B. Deliver materials to site at such times and intervals to ensure continuity of installation and uninterrupted progress of work.

C. Store materials to permit easy access for inspection and identification. Support stainless steel members off ground on racks made from carbon steel-free surfaces such as wood, rubber or plastic. Materials showing evidence of damage will be rejected and shall be immediately removed from the site.

D. Handle stainless-steel so no parts are bent, broken, or otherwise damaged and avoid damage to other material and work. Store beams with webs vertical. Exercise care to avoid over stressing the steelwork.

E. Mark weight on all members. Match-mark all shop pre-fitted members.

F. Ship small parts, such as bolts, nuts, washers, pins, fillers, and small connecting plates and anchors in boxes, crates, or barrels. Pack separately each length and diameter of bolt

and each size of nut and washer. Plainly mark an itemized list and description of the contents on the outside of each container.

G. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Replace damaged materials or structures as directed.

H. Use isolating material to protect structural stainless-steel when using carbon steel lifting chains, hooks, cleats, and fork lifts. Avoid using chemicals such as oils and grease. Care shall be exercised to avoid abrasions and other damage.

I. All fasteners and washers shall be delivered to the site, where they will be installed, in unopened containers.

J. Quarantine tools as necessary to prevent contaminating or impregnating structural stainless-steel members and components with carbon steel.

1.6 JOB CONDITIONS

A. Provide anchor rods and other anchorage items to be embedded in or attached to concrete, masonry, or other materials in ample time to not delay work.

1. Furnish setting drawings, templates, and installation directions.

B. Environmental Requirements For Welding:

1. When welding during cold weather, apply preheat and controlled cooling in accordance with the approved welding procedure specification (WPS). Avoid chilling weld metal within zone of welding influence and avoid restraining manual functions of welder or welding operator.
2. When temperature where steel is stored is more than 20 degF below that of welding shop, move steel to be welded into shop sufficiently in advance of welding to allow it to attain shop temperature prior to welding.
3. Stainless-steel shall be free of moisture. Dry as necessary by application of heat in accordance with the approved welding procedure specification (WPS), but not exceeding 100 ° F.
4. Do not weld when shop temperature is below 40 ° F.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Bars and Shapes:

1. ASTM A 276 Type 304

B. Stainless-Steel Tubes

1. ASTM A 554 Type 304

C. Stainless Steel Plate, Sheet, and Strip

1. ASTM A 240, Type 304

D. Stainless Steel Fasteners

1. Bolts, Threaded Rods, Rods and Pins:
   a. ASTM F593, Type S31600 (Alloy Group 2)
   b. ASTM F593, Type S17400 (tension rods & pins)
2. Nuts
   a. ASTM F594

E. Welding Electrodes for Stainless-Steel:

1. Conform to AWS D1.6. Base selection of electrodes on the actual properties of the metal connected.
2. Filler Metal Group A-70 ksi Minimum Tensile Strength

F. Adhesive Anchors:

1. Provide stainless steel adhesive anchors complying with ASTM F 593, AISI Type 316L with stainless steel nuts and locknuts complying with ASTM F594.
2. Anchors shall be of the size required for the concrete strength specified.
3. Adhesive anchors shall consist of threaded rods anchored with an adhesive system into hardened concrete. The adhesive system shall use a two-component adhesive mix and shall be injected with a static mixing nozzle following manufacturer's instructions. The embedment depth of the rod shall provide a minimum allowable bond strength that is equal to the allowable tensile capacity of the rod, unless noted otherwise on the Drawings.
4. Provide one of the following adhesives:
   a. Hilti HIT-HY 200
   b. Or approved equal with ICC-ES report.

G. Studs:

1. Studs for bolted connections referenced on Drawings are automatically end welded externally and fully threaded studs.
2. Conform to ASTM A 276, Type 316L (31603)
3. Stud welding shall comply with AWS D1.6. Do not fillet weld studs without written approval from the Engineer.
4. Provide the following:
   a. Neslon CFL Fully Threaded Studs
   b. Or approved equal.

H. Non-Shrink Grout:

1. Premixed non-shrink, non-corrosive compound consisting of non-metallic aggregate, cement; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 6,000 psi in 28 days; "Five-Star Grout" manufactured by US Grout Corporation or similar approved.

2.2 FABRICATION

A. Fabricate structural steel in accordance with the Contract Drawings, the AISC standards referenced in Paragraph 1.03A, and Chapter 7 of NiDI “Design Manual for Structural Stainless Steel”.

1. All structural elements including columns, framing members, bracing, etc. shall be shop fabricated and field assembled. No field welding is allowed.

B. Perform flame cutting, and chipping carefully and accurately so as not to induce residual stress in the metal being cut.

1. Flame-cut the edges of members either by using a mechanically guided torch or by hand, and remove all nicks.
    a. Assume all thermally cut edges are subject to substantial stresses.
    b. Fabricate the radii of re-entrant gas-cut fillets as large as practicable, but in no case less than ¾ inch.
    c. Perform flame cuttings so that the metal is not carrying stress.
    d. Finish the exposed edges of members that were flame-cut by hand by grinding.

C. Bolt Holes:

1. Drill, and do not punch, holes for bolts as required in accordance with the requirements specified in the AISC Specifications referenced in Paragraph 1.03A.

D. Holes for Other Work:

1. Provide holes required for securing other work to structural steel framing and for passage of other work through members as shown on final approved shop drawings.
    a. Ream, drill, or punch holes perpendicular to metal surface.
    b. Do not flame cut holes or enlarge by burning.
2. Do not make additional openings in members not shown on the final approved shop drawings unless approval to do so is received from the Engineer.

E. Strut Ends
1. Mill the forked ends of strut members that will transmit loads in bearing.
2. Provide minimum wall thickness consistent with the strut pipe member.
3. Weld ends to strut pipe member with complete joint penetration weld as shown on the Drawings.
4. Provide finish of strut ends consistent with the strut pipe and complying with the finishes of architecturally exposed structural steel as specified herein.

F. Except where welded connections are shown, use stainless Type S31603 bolts for shop connections.

1. Install bolts snug-tight in accordance with the requirements of the RCSC Specification for Structural Joints Using High-Strength Bolts.
2. Arrange the bolts as indicated on the Drawings; or if not indicated, arrange the bolts so heads show in areas exposed to view.
3. Clearly indicate the bolt arrangements on shop drawing submittals.

G. Welding:

1. Perform all welding in accordance with AWS D1.6 except as modified herein.
2. Use a welding procedure and sequence of welding that prevents needless distortion and minimize stresses.
    a. If it is necessary to straighten transverse warpage of flanges, use controlled heating along outside face.
    b. Allow for expected weld shrinkage when laying out and assembling members in the shop.
    c. Trim members to size only when most or all of welding has been completed.
3. All welding shall be performed in the shop, no welding is allowed at the job site.

H. Stainless Steel Welding

1. Welding shall be in accordance with AWS D1.6 "Structural Welding Code “Stainless Steel”.
    a. Contractor is responsible for selection of specific materials and procedures except as specifically noted in contract documents.
    b. Connections have varying levels of restraint and thus necessary steps shall be taken by Contractor to control or accommodate the restraint.
    c. Welding and fabrication procedures shall incorporate measures necessary to eliminate cracking.
    d. When selecting materials and procedures, consideration shall be given to the need for materials and procedures in excess of code requirements.
    e. The need for pre-heat and other procedures are to be based on the actual chemistry and mechanical properties of the steel and not solely on the specified properties of the steel.
    f. Limit maximum interpass temperatures so as not to decrease toughness and strength of the weld metal.
    g. Weld variables shall be consistent with the recommendations of the electrode manufacturer.
    h. Welding Procedure Specifications shall be readily available to all welders, inspectors, and supervisors during the production process.
    i. Weld only in accordance with the WPSs.
    j. Do not mix different electrodes in the same weld joint.
    k. Use stringer beads only (no weaving).
    l. No tack welds not incorporated into a weld will be allowed on the finished structure.
2. All groove or butt welds shall be full penetration unless noted otherwise on the Drawings.
3. Sequence the work as necessary to accommodate testing.
4. Weld sizes where shown shall be assumed to be the effective weld sizes.

I. Bending Architecturally Exposed Steel

1. When bending steel plate:
    a. Bend plates perpendicular to the rolling direction.

b. Grind flame cut plate edges transverse to the bend line.
c. Grind out nicks in plate edges transverse to the bend line.
d. Round sharp corners on plate edges transverse to the bend line.

2. Members are structural and architectural, and require care when bending. Cold bend structural members prior to any other fabrication such as drilling holes, welding, cutting penetrations, coping, etc. Effects such as tears, fractures, wrinkling or local web or flange buckling are not acceptable.
3. Tolerances in cross section distortion from cold bending.
   a. Loss of Depth tolerance = 2% of depth, max
   b. Loss of Width tolerance = 2% of width, max
   c. Warping of web face = 2% of face dimension, max

J. Architecturally Exposed Steel

1. All members exposed to view in the completed structure shall be classified as "Architecturally Exposed Structural Steel".
2. Comply with the provisions of Section 10 of the AISC Code of Standard Practice for Steel Buildings and Bridges regarding architecturally exposed structural steel.
   a. Abutting cross sectional configurations shall match.
   b. Remove backing bars.
   c. Remove weld runoff tabs and grind smooth with stainless steel brush or other inert material.
   d. All surfaces and welds exposed to view shall be treated as finished surfaces.
3. Exposed Welds:
   a. All exposed fillet welds shall be made smooth of uniform convex contour, radius and dimension for their full length; grind smooth using a stainless-steel brush or other inert material, if welds were not made to this criteria.
   b. Dressing of any welds for finish shall not reduce the specified effective throat or structural integrity of the weld.
4. Weld show-through shall not be permitted.
5. Remove weld splatter on architecturally exposed steel.
6. All exposed corners shall be square and sharp, eased to a radius of 1/4 in.

K. Stainless Steel Bolting:

1. Bolts shall be of a length that will extend not more than 1/4 in beyond the nuts unless noted otherwise.
2. Stainless steel washers shall be used on bolts. Use beveled washers where bolts bear on sloping surface.
3. Bolts shall be installed such that no threads occur in the shear plane.
4. Manufacturer’s symbol and grade markings shall appear on all bolts and nuts.
5. Product containers must be marked so that correspondence with mill reports can be established.
6. Holes in column base plates shall be as shown on the Drawings.

7. When bolt holes are subject to welding shrinkage stresses the holes shall be drilled.

L. Properly mark and match-mark materials to facilitate handling and field assembly.

1. Mark each member with its weight.
2. Match-mark all shop pre-fitted members.

2.3 FINISHES

A. Cleaning:

1. After fabrication, clean and remove deposits of oil and grease from stainless-steel surfaces in accordance with AISC's "Code of Standard Practice."

B. Finishes of Architecturally Exposed Steel

1. All surfaces of architecturally exposed structural steel members shall be uniform in appearance, including smoothness and texture, when viewed in direct sunlight at a distance of 10 feet, at angles of incidence 0 degree to 90 degree at completion.
2. Surface Appearance: The initial condition of the steel to be exposed in use shall conform to dull polished finish No. 4 with RMS surface roughness equivalents (Ra) of 0.5 microns or 20 micro-inches. The exposed surfaces, edges and ends of all plates and other components shall be free of any surface defects including weld splatter, burrs, dents, gouges, occlusions, streak, ridges and recesses.
3. Achieve surface finish through the use of the glass bead-blasting technique. Multiple passes with blasting media may be required to obtain correct finish.

2.4 SOURCE QUALITY CONTROL

A. Materials and fabrication procedures are subject to inspection and tests by an Independent Testing and Inspection Agency (Approved Agency) in the mill and shop. Provide the Approved Agency with the following.

1. Access and facilities, including scaffolding, temporary work platforms, etc., for testing and inspection at all places where materials or components are stored or fabricated, so the required inspections and testing can be performed before the work is shipped and also in their erected position.
2. A complete set of accepted "Submittals".
3. Cutting lists, order sheets, material bills, and shipping bills.
4. Representative sample pieces as requested by the testing agency.
5. Full and ample means and assistance for testing all material.
6. Access and facilities, including scaffolding, temporary work platforms, etc., for testing and inspection at all places where materials or components are stored or fabricated, and also in their erected position.

B. Fabricated members are subject to inspection by the Architect in addition to inspections by an Independent Testing and Inspection Agency (Approved Agency). Architectural inspections are required at the following stages.

1. After bending of steel and before welding bent members to other members.
2. After fabrication of Main Girder Tapers and Roostplate.
3. Full frame prior to finishing.
4. Full frame after finishing and before shipment from the shop.

C. Scheduling of Tests and Inspections

1. The Contractor shall notify the Inspector in sufficient time prior to fabrication or erection work to allow testing and inspection without delaying the work.
2. Shop welds will be inspected in the shop before the work is shipped.

D. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the Inspector can refer back to the person making the connection.

E. Shop Welding:

1. The Approved Agency will verify all welders and welding materials being supplied under this Contract are properly certified and will conduct the inspections and tests specified.
    a. Inspect and test shop welds made during fabrication of structural steel assemblies by performing a visual inspection of the full length of all welds and inspecting and testing shop-welded connections in accordance with the requirements of ASTM E 164 and the following:
        1) Ultrasonically inspect and test the entire length of all full penetration welds in accordance with the requirements of ASTM E164.
        2) Inspect the entire length of fillet welds in accordance with the requirements for the Magnetic Particle Method specified in ASTM E 709 and the following:
            a) For gusset plates welded to steel members, test 20 percent of fillet weld locations.
            b) For all other fillet weld locations, test a minimum of 5 percent of the welds.
    b. Record both the type and location of all defects found in the work, and record the work required and the work performed to correct deficiencies.
2. Acceptance Criteria:
    a. Verify weld materials, locations, and types agree with Construction Documents.
    b. Verify welds comply with AWS D1.1.

F. Submit mill test reports certifying the material provided conforms to the appropriate ASTM specification.

G. Promptly remove and replace materials or fabricated components that do not comply with specified requirements.

H. Non-destructive Testing and Inspections

1. Non-destructive testing to be conducted by personnel qualified as NDT Level II or Level III in accordance with ADNT SNT-TC-1A.
2. Level II technicians to be supervised by Level III personnel.
3. As a minimum the Inspector will make all tests and inspections as required by the Building Code of the relevant jurisdiction. The Inspector will make all the tests and inspections indicated in the Construction Documents.
4. The Inspector will make all verification tests and inspections as required by AWS D1.6 "Structural Welding Code - Stainless Steel".
5. Do not reduce testing frequency unless permission is obtained from Architect.
6. Inspector shall be present during all welding operations.
7. Verify that welders are certified.
8. Check materials, equipment and procedures. Verify meters on welding equipment are functioning and are accurate.
9. Visual Inspection:
    a. Visually inspect all welds.
    b. Visual inspection of multi-pass welds to be continuous.
    c. Visually inspect welds at least 72 hours after completion of welding for the presence of cracks.
    d. Verify the effective throat thickness of flare groove welds is consistently obtained when flush to bar or section. This verification shall be based on test sections where necessary.
10. Test Methods:
    a. Butt welds will be tested using magnetic particle test methods and either ultrasonic or radiographic test methods.
    b. Butt welds to pipes and tubes to be tested using magnetic particle tests.
    c. Use magnetic particle test methods for filet welds and to supplement the testing requirements for butt welds.
    d. For radiographic a double film technique will be used. One copy of each film will be sent to the Architect, the other will be retained by the Inspector.
    e. In addition to the non-destructive testing specified other non-destructive test methods recognized by AWS D1.6 may be used at the Architect’s discretion and the results can be used to reject work under this contract.
11. Frequency of non-destructive examination is to be as follows:
    a. Full Penetration Butt Welds: 100 percent.
    b. Partial Penetration Butt Welds with a leg length greater than 1/2 in: 20 percent min. ultrasonic or radiographic inspection.
    c. Test 100 percent of partial penetration butt welds used in field splices.
    d. Test 20 percent of total length of all welds joining web plates to flanges.
    e. Fillet and other welds not otherwise inspected - a minimum of 10 percent.

f. Selection of welds to be examined: Where there is a requirement for less than 100% examination the method of selection of welds to be examined is to be agreed with the Architect before commencement of the work. If the Architect does not provide more specific criteria, inspectors will select the welds to be tested. The inspectors will chose specific weld so as to obtain results that are representative of the conditions in the structure. In addition inspectors will emphasize those locations that experience has shown are more likely to have problems.

12. Where inspection reveals unacceptable defects:
    a. The extent of inspection will be increased to provide confidence that the defects in a joint has been found and to assure that the problem is not systematic.
    b. As a minimum, examine two additional joints in the group represented by the joint. If the non-destructive examination of the two additional joints reveals unacceptable defects, examine each joint in the group. I. Take samples of all welding consumables and store in sealed containers.

J. Tests of Stainless-Steel Bolts, Nuts and Washers:

1. The Inspector will randomly select at least five bolts for test purposes from each bin of bolts furnished.
2. Confirm that the faying surfaces have been properly prepared before connections are assembled.

K. Inspection Records

1. Make systematic record of all welds, including:
    a. Location and type of weld.
    b. Identification marks of welders.
    c. List of defective welds.
    d. Manner of correction of defects.
2. The Inspector will maintain a daily record of the work that has been inspected and its disposition. One copy of each of the report will be submitted to the Owner on a weekly basis. Test reports will be made on the form suggested in the AWS D1.6 "Structural Welding Code “Stainless Steel."

L. Mill Reports: Testing laboratory will review mill reports for conformance to referenced standard.

M. Post-Installed Anchor Load Testing

1. All post-installed anchors in existing concrete, where shown on documents, shall be subjected to on-site suitability tests. Testing of all anchors shall be performed by loading in at least 4 equal increments, in accordance with the table below.

Load Cycle	Load	Hold Duration (minutes)
First Cycle	10% max	1
Second Cycle	40% max	1
Third Cycle	80% max	1
	100% max	15
	80% max	1
	40% max	1
	20% max	1
	0	

2. The peak test load shall be as follows.
   a. 1" diameter Anchor Rods = 8,000 lbs.
3. Configure post-installed anchor testing apparatus so that the adhesive bond strength is tested and the anchor is not subject to concrete break-out failure.
4. Anchors selected for testing shall not be loaded until adhesive has cured fully in accordance with manufacturer's recommendations.
5. At each increment, the load shall be held at a constant value and the deflection noted every 30 seconds, for the duration of the period quoted. If deflection has not ceased at the end of the hold period, the duration shall be extended until it does cease. Deflection shall be assumed to have ceased when the dial gauges remain unchanged for more than three consecutive readings.
6. Anchors shall be deemed to have failed if in the opinion of the Engineer, the anchor shows evident signs of failure under load or if the residual deflection immediately after the removal of the load is more than 10% of the maximum deflection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before proceeding to erect the structural stainless-steel, verify the elevations of concrete bearing surfaces and locations of anchorages are in compliance with the Contract Documents and ready to receive the work of this Section.

B. Ensure anchor rods and other embedded items, that vary in location from the dimensions shown on the Contract Drawings, are positioned within the tolerances listed in the AISC "Code of Standard Practice for Steel Buildings and Bridges".

C. Do not proceed with erection until unsatisfactory conditions have been corrected.

1. Immediately report errors in the structural steel, whether resulting from shop fabrication or deformation resulting from handling or transportation, which will prevent the proper erection and fitting of parts.
2. In the event of discrepancy, immediately notify the Architect in writing.

3. Do not proceed with construction in the region of the discrepancy until all such discrepancies have been resolved.

D. Secure field measurements required for proper and adequate fabrication and installation of the work covered in this Section. Assume responsibility for exact measurements.

E. Furnish templates for exact locations of items to be embedded in concrete and any setting instructions required for installation.

3.2 ERECTION

A. General:

1. Structural steel shall be erected in accordance with Chapter M of AISC Specifications and the Drawings and Specifications and with the AISC Code of Standard Practice.
2. Erection of architecturally exposed structural steel shall be in accordance with Section 10.5.1 and 10.5.2 of AISC Code of Standard Practice for Steel Buildings and Bridges.
3. Dimensions shown on Drawings are based on an assumed design temperature of 70 deg F. Fabrication and erection procedures shall take into account the ambient temperature range at the time of the respective operations.
4. Care shall be taken to protect work already installed from damages resulting from structural steel erection.

B. Erect steel structures aligned and plumb in the location and at the elevations shown on the Drawings and in accordance with the match marks, pertinent regulations, and the AISC standards referenced in Paragraph 1.03A.

1. Align column bases and bearing plates for beams and similar structural members using stainless-steel wedges or shims.
2. Do not field cut or alter structural members without the approval of the Engineer.
3. Do not tighten anchor rod hardware using impact torque wrenches. C.

Temporary Shoring and Bracing:

1. Provide temporary shores, guys, braces, and other supports during erection to protect the structure against damage and to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads including, but not limited to, other loads such as wind and seismic forces.
2. Leave temporary bracing in place as long as required for safety.
3. Provide temporary works as necessary to erect the structure.
4. Contractor is responsible for identifying need for temporary construction. D.

Field Assembly:

1. Set structural members to the lines and elevations indicated. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
2. Before assembly clean bearing surfaces and other surfaces which will be in permanent contact after assembly.

3. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream holes that need to be enlarged to admit bolts. Where a hole is required to be enlarged by more than 3/32-inch, ream to and use next larger bolt size.
4. Do not use gas cutting torches in the field for correcting fabricating errors in the structural framing unless accepted by the Architect. Finish gas cut sections equal to a sheared appearance when permitted.
5. The quality of field welds or bolting shall be the same as that performed in the shop.
6. Erection bolts for welded connection shall be tightened securely and left in place.
7. Erection Bolts: On architecturally exposed steel construction, remove erection bolts, fill holes with plug welds, and grind exposed surfaces smooth.

E. Adhesive Anchors:

1. For the adhesive anchors and adhesive material, comply with details on the Drawings and the manufacturer's installation instructions on the hole diameter, depth, and drilling technique. Properly clean out the hole utilizing a wire brush and compressed air to remove all loose material from the hole, prior to installing adhesive capsules or material. Install anchors only after concrete has reached its minimum specified strength.
2. Do not disturb anchors or tighten nuts until the adhesive has fully cured. F.

Setting Base Plates:

1. Prepare surface of existing concrete as if for a concrete construction joint. Clean the bottom surface of base plates.
2. Tighten anchor rods after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base plate prior to installing grout.

G. Bolted Connections:

1. For connections using stainless-steel bolts, conform to requirements of the AISC Specifications referenced in Paragraph 1.3.A.
   a. Assemble bolted parts so they fit solidly together when assembled.
      1) Remove scale, dirt, and other defects liable to prevent proper seating when joint surfaces are assembled, including joint surfaces adjacent to washers.
      2) Do not use gaskets or any other interposed compressible materials.
      3) Only use drift pins for bringing members into position, not to enlarge or distort holes.
2. Provide stainless-steel washers under the bolt head and nut in all bolted connections.
3. Ensure holes are not enlarged and the metal in the vicinity of the holes is not disturbed by drifting during assembly.
   a. Enlarge holes to admit bolts for connections only if approved by the Engineer.

1) Make the enlargement by reaming and not by burning.
2) Avoid hand reaming.

4. As erection progresses, install sufficient bolts in the work to resist dead loads, wind loads, and erection loads.

a. Arrange and insert the bolts so bolt heads show in areas exposed to view.

b. Perform permanent bolting when sufficient alignment has been completed to ensure as much of the structure as possible will be supported by such fastening work.

H. Field Welding:

1. Provide only where approved by the Engineer.
2. Protect adjacent fabrications and finished surfaces from marring or damage caused by field welding. Provide finish of field welds in conformance with the Architectural finish specified herein for exposed stainless steel.

I. Base Plate Grouting:

1. After the supported members have been aligned, properly positioned, and the anchor nuts have been tightened, dry-pack the entire area under bearing plates with non-shrink grout. Leave no voids between the base plates and the concrete.
2. Base plate grout shall be mixed and applied in strict accord with manufacturer's directions.

3.3 FIELD QUALITY CONTROL

A. At the Owner’s option, an Independent Testing and Inspection Agency (Approved Agency) shall be engaged to inspect bolted connections and welded connections, to perform the specified tests, and interpret the test results; to confirm that the structure is square, plumb, and level in accordance with AISC tolerances and to prepare and submit test reports for this work.

B. Field-Bolted Connections:

1. The Approved Agency will inspect and test the field-bolted structural steel connections in accordance with the AISC specifications listed in Paragraph 1.03A and as specified.
   a. Verify proper fastening components were used.
   b. Verify the connected elements were fabricated properly.
2. Acceptance Criteria:
   a. Verify proper fastening component used.
   b. Verify proper fabrication of connected elements.

C. Field Welding:

1. The Approved Agency will verify all welders and welding materials in the field are properly certified and will conduct the inspections and tests specified.
   a. Inspect and test field welds, in accordance with the requirements of AWS D1.1 and D1.6, made during erection of structural steel assemblies by

performing a visual inspection of the full length of all welds and the following:

1) Ultrasonically inspect and test the entire length of full penetration welds in accordance with the requirements of ASTM E 164
2) Inspect the entire length of fillet welds in accordance with the requirements for the Magnetic Particle Method specified in ASTM E 709 and the following:
    a) For gusset plates welded to steel members, test 40 percent of fillet weld locations.
    b) For all other fillet weld locations, test a minimum of 10 percent of the welds.

b. Record both the type and location of all defects found in the work, and record the work required and the work performed to correct deficiencies.

2. Acceptance Criteria:
    a. Verify proper fastening component used.
    b. Verify proper fabrication of connected elements.
3. Field welds and field bead blasting are subject to inspection by the Architect.

PART 4 – MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all furnishment and installation of structural stainless steel materials as required per the contract documents. This includes but is not limited to fabrication of structural stainless steel girders and columns, all connections and anchors, finishing as required, and erection of all structural stainless steel.

END OF SECTION 051300

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Acoustical roof deck.
3. Composite floor deck.
4. Noncomposite form deck.
5. Noncomposite vented form deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For welding personnel.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASC Steel Deck; ASC Profiles, LLC.
2. CSM Metal Deck.
3. Canam Buildings US Inc.; Canam Group Inc.
4. Cordeck.
5. DACS, Inc.
6. Epic Metals Corporation.
7. Marlyn Steel Decks, Inc.
8. Miami Metal Deck.
9. New Millennium Building Systems, LLC.
10. OEG Building Materials Inc.

11. Roof Deck, Inc.
12. Tristate Decking, Inc.
13. Valley Joist.
14. Verco Decking, Inc.; a Nucor company.
15. Vulcraft Group; Division of Nucor Corp.
16. Approved Equivalent.

B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230) G60 (Z180) zinc coating.
2. Deck Profile: As indicated on the plans.
3. Profile Depth: As indicated on the plans.
4. Design Uncoated-Steel Thickness: As indicated on the plans.
5. Span Condition: As indicated on the plans.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASC Steel Deck; ASC Profiles, LLC.
2. CSM Metal Deck.
3. Canam Buildings US Inc.; Canam Group Inc.
4. Cordeck.
5. DACS, Inc.
6. Epic Metals Corporation.
7. Marlyn Steel Decks, Inc.
8. Miami Metal Deck.
9. New Millennium Building Systems, LLC.
10. OEG Building Materials Inc.
11. Roof Deck, Inc.
12. Tristate Decking, Inc.
13. Verco Decking, Inc.; a Nucor company.
14. Vulcraft Group; Division of Nucor Corp.
15. Approved Equivalent.

B. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Profile Depth: As indicated on the plans.
3. Design Uncoated-Steel Thickness: As indicated on the plans.
4. Span Condition: As indicated on the plans.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [level] [sloped] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 18 inches (460 mm) apart, maximum.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches (460 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (50 mm) minimum].

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (300 mm) apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing:

a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches (400 mm) apart, but not more than 18 inches (460 mm) apart.
b. Space and locate welds as indicated.

3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (1 m), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.
3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.

C. Prepare test and inspection reports.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all furnishment and installation of all steel deck as required per the contract documents. This includes but is not limited to fabrication of steel roof and floor decking, all connections and anchors, priming and/or galvanizing as required, all steel decking accessories, and erection of all steel decking.

END OF SECTION 053100

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY-

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

B. See Division 05 Section "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs or to walls adjacent to metal stairs.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor is 1.5.

1.3 SUBMITTALS

A. Product Data: For metal stairs.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified New Jersey professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.
2. Industrial-Type Stairs: Industrial class.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed).

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

F. Wire Rod for Grating Crossbars: ASTM A 510.

G. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

H. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.

I. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30, unless another grade is required by design loads.

J. Expanded-Metal, Carbon Steel: ASTM F 1267, Type I (expanded).

1. Style Designation: 3/4 number 13.

K. Woven-Wire Mesh: Intermediate-crimp, diamond pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

L. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.2 MISCELLANEOUS MATERIALS

A. Cast-Metal Units: Cast iron, with an integral abrasive, as-cast finish.

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. American Safety Tread Co., Inc.
b. Balco Inc.
c. Barry Pattern & Foundry Co., Inc.
d. Granite State Casting Co.
e. Safe-T-Metal Company, Inc.
f. Wooster Products Inc.

B. Extruded Units: Aluminum units with abrasive filler in an epoxy-resin binder.

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. ACL Industries, Inc.
b. American Safety Tread Co., Inc.
c. Amstep Products.
d. Armstrong Products, Inc.
e. Balco Inc.
f. Granite State Casting Co.
g. Wooster Products Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

F. Fasteners: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

G. Shop Primers: Provide primers that comply with Division 09 painting Sections.

H. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

J. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

K. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

L. Precast Concrete Treads: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi and a total air content of not less than 4 percent or more than 6 percent. Reinforce with galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter wire; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

2.3 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without impairing work.

E. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.

5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.4 STEEL-FRAMED STAIRS

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. Alfab, Inc.
2. American Stair, Inc.
3. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel channels.
2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, sub tread pans, and sub platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
2. Provide epoxy-resin-filled treads, reinforced with glass fibers, with slip-resistant, abrasive surface.

D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.097 inch.. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

E. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from rolled-steel floor plate of thickness[needed to comply with performance requirements, but not less than 1/4 inch. Form treads with integral nosing and back edge stiffener. Weld steel supporting brackets to stringers and weld treads to brackets.

F. Metal Bar-Grating Stairs: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from steel grating with 1-by-3/16-inch bearing bars at 11/16 inch o.c and crossbars at 4 inches o.c.
2. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.

2.5 STAIR RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: **1-5/8-inch-** diameter top and bottom rails and 1-1/2-inch- square posts.
2. Picket Infill: 1/2-inch- square pickets spaced less than 4 inches clear.
3. Expanded-Metal Infill: Expanded-metal panels with long dimension of diamonds perpendicular to top rail.
4. Perforated-Metal Infill: Perforated-metal panels with pattern as indicated on Drawings.
5. Mesh Infill: Woven wire mesh in steel channel frames with horizontal and vertical.
6. Intermediate Rails Infill: 1-5/8-inch diameter intermediate rails spaced less than 21 inches clear.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.

C. Form changes in direction of railings by bending.

D. Form curves by bending members in jigs to produce uniform curvature without buckling.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Connect posts to stair framing by direct welding.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, to transfer wall bracket loads through wall finishes. Size fillers to suit wall finish thicknesses.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Apply shop primer to uncoated surfaces of metal stair components. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

B. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.

D. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

E. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.

F. Install precast concrete treads with adhesive supplied by manufacturer.

G. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part.

END OF SECTION 055100

SECTION 055300 - METAL GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal bar gratings.
2. Formed-metal plank gratings.
3. Metal frames and supports for gratings.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.

C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7

1.3 SUBMITTALS

A. Product Data: For the following:

1. Formed-metal plank gratings.
2. Clips and anchorage devices for gratings.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 15 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

D. Wire Rod for Bar Grating Crossbars: ASTM A 510 .

E. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.

F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 with G90 coating.

G. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316.

H. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316.

2.2 ALUMINUM

A. Extruded Bars and Shapes: ASTM B 221 alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless steel fasteners for fastening stainless steel.

B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.5 FABRICATION

A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

C. Fit exposed connections accurately together to form hairline joints.

D. Fabricate toeplates for attaching in the field.

2.6 METAL BAR GRATINGS

A. Pressure-Locked, Rectangular Bar Aluminum Grating:

1. Bearing Bar Spacing: Match Existing
2. Bearing Bar Depth: Match Existing
3. Bearing Bar Thickness: As required to comply with structural performance requirements.
4. Crossbar Spacing: As required to comply with structural performance requirements.
5. Traffic Surface: Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive.

B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

D. Do not notch bearing bars at supports to maintain elevation.

2.7 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum

anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.
2. Interior

2.8 STEEL FINISHES

A. Finish gratings, frames, and supports after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

C. Shop prime gratings, frames and supports not indicated to be galvanized unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

B. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Attach toeplates to gratings by welding at locations indicated.

D. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part.

END OF SECTION 055300

SECTION 061753 - WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and related specifications, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Triangular-pitched roof trusses.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 061000 "Rough Carpentry".

1.3 DEFINITIONS

A. Metal-plate-connected wood trusses include planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and erect metal-plate-connected wood trusses to withstand design loads within limits and under conditions required.

1. Design Loads: As indicated.
2. Design trusses to withstand design loads without deflections greater than the following:
a. Roof Trusses: Vertical deflection of 1/240 of span due to total load.

B. Engineering Responsibility: Engage a fabricator who uses a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for metal-plate-connected wood trusses.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for lumber, metal-plate connectors, metal framing connectors, bolts, and fasteners.

C. Shop Drawings detailing location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber to be used; splice details; type, size, material, finish, design values, and orientation and location of metal connector plates; and bearing details.

1. To the extent truss design considerations are indicated as fabricator's responsibility, include structural analysis data signed and sealed by the qualified professional engineer licensed in the State of New Jersey responsible for their preparation.
2. Include truss Shop Drawings signed and sealed by the qualified professional engineer licensed in the State of New Jersey responsible for their **preparation**.

D. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee (ALSC) Board of Review.

E. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to truss fabricator.
3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed wood truss installation similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator's Qualifications: Engage a firm that complies with the standard industry requirements for quality control and is experienced in fabricating metal-plate-connected wood trusses similar to those indicated for this Project and with a record of successful in-service performance:

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses with care and comply with manufacturer's written instructions and TPI recommendations to avoid damage and lateral bending.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 SEQUENCING AND SCHEDULING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Metal Connector Plates:

    a. Alpine Engineered Products, Inc.
    b. Computrus, Inc.
    c. Mitek Industries, Inc.
    d. Robbins Manufacturing Company.
    e. Tee-Lok Corporation.
    f. Truswal Systems Corporation.
    g. Or Equal.

2. Metal Framing Anchors:

    a. Cleveland Steel Specialty Co.
    b. Harlen Metal Products, Inc.
    c. Silver Metal Products, Inc.
    d. Simpson Strong-Tie Company, Inc.
    e. Southeastern Metals Manufacturing Co., Inc.
    f. United Steel Products Co.
    g. Or Equal.

2.2 DIMENSION LUMBER

A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority (Canadian).
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

D. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified, to comply with requirements indicated below:

1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber to a maximum moisture content of 19 percent.

C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber after drying and discard damaged or defective pieces.

2.4 METAL CONNECTOR PLATES

A. General: Fabricate connector plates from metal complying with requirements indicated below.

B. Hot-Dip Galvanized Steel Sheet: Structural-quality steel sheet, zinc coated by hot-dip process complying with ASTM A 653, G60 coating designation; Grade 33 and not less than 0.0359 inch thick.

C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, structural-(physical) quality steel sheet, zinc coated by electrodeposition; 33,000-psi minimum yield strength, coating class C, and not less than 0.0474 inch thick.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified below for material and manufacture.

1. Where truss members are exposed to weather or to high relative humidities, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of stainless steel, Type 304 or 316.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts and Screws: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Protective Coatings: Provide one of the following coating systems:

1. SSPC-Paint 22, epoxy-polyamide primer.
2. SSPC-Paint 16, coal-tar epoxy-polyamide black or dark red paint.
3. SSPC-Paint 27 and SSPC-Paint 12, basic zinc chromate-vinyl butyral wash primer and cold-applied asphalt mastic.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to size, configuration, thickness, and anchorage details required to withstand design loadings for types of joint designs indicated.

C. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances of ANSI/TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances of ANSI/TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously into both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

B. Install and brace trusses according to recommendations of TPI and as indicated.

C. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

D. Space, adjust, and align trusses in location before permanently fastening and as follows:
1. Truss Spacing: 24 inches o.c.

E. Anchor trusses securely at all bearing points using metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.

3.2 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.Retain below if an added corrosion-resistant coating of embedded-metal connector plates is required.

4.01 QUANITY AND PAYMENT

Include all costs for material and labor for complete installations of the trusses in the lump sum price bid for the related item of work as listed in the bid form.

END OF SECTION 061753

SECTION 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes asphalt shingles for steep roofs and low roofs.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Flashing and Sheet Metal for metal valley flashing, step flashing, drip edges, and other sheet metal work.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product data for each type of product specified, including details of construction relative to materials, dimensions of individual components, profiles, textures, and colors.

C. Samples for initial selection in the form of manufacturer's sample finishes showing the full range of colors and profiles available for each type of asphalt shingle indicated. Owner shall select style and color of shingles.

D. Samples for verification in the form of 2 full-size units of each type of asphalt shingle indicated showing the full range of variations expected in these characteristics.

E. Manufacturer’s installation procedures including all flashing and fastening methods and details.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Classification: Where products with a fire-test-response classification are specified, provide asphalt shingles identical to those tested according to ASTM E 108 or UL 790 and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify each bundle of asphalt shingles with appropriate markings indicating fire-test-response classification of applicable testing and inspecting agency.

B. Wind-Resistance-Test Characteristics: Where wind-resistant asphalt shingles are indicated, provide products identical to those tested according to ASTM D 3161 or UL 997 and passed. Identify each bundle of asphalt shingles with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's unopened bundles or containers with labels intact.

B. Handle and store materials at Project site to prevent water damage, staining, or other physical damage. Store roll goods on end. Comply with manufacturer's recommendations for job-site storage, handling, and protection.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installing asphalt shingles only when existing and forecasted weather conditions will permit work to be performed according to manufacturers' recommendations and warranty requirements, and when substrate is completely dry.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace asphalt shingles that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, deformation or deterioration of asphalt shingles beyond normal weathering.

1. Warranty Period: Manufacturer's standard but not less than 30 years after date of Final Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Furnish 1 square (9.29 sq. m) coverage of asphalt shingles, identical to those to be installed, in unbroken bundles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. GAF Materials Corporation
2. CertainTeed Corporation.
3. Georgia-Pacific Corporation
4. Owens-Corning Fiberglas Corporation
5. Or Equal

2.2 ASPHALT SHINGLES

A. Colors, Blends, and Patterns: Where manufacturer's standard products are indicated, provide asphalt shingles with the following requirements:
1. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.
2. Provide selections from manufacturer's full range of colors, textures, and patterns for asphalt shingles of type indicated.
3. Owner shall select the style and color of shingles.

B. Three-Dimensional, Fiberglass, Laminated Strip Shingles: Mineral-surfaced, self-sealing, laminated, multi-ply overlay construction, fiberglass-based, strip asphalt shingles, complying with both ASTM D 3018, Type I, and ASTM D 3462. Provide shingles with a Class A fire-test-response classification that pass the wind-resistance-test requirements of ASTM D 3161. Shingles shall be Timberline 30 Shingles as manufactured by the GAF Materials Corporation or equal. Color to be selected by owner.

C. Hip and Ridge Shingles: Manufacturer's standard, factory-precut units to match asphalt shingles, if available; or job-fabricated units cut from actual asphalt shingles used.

2.3 METAL TRIM AND FLASHING

A. Sheet Metal Materials: Furnish the following sheet metal materials:
1. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003 H14 with mill finish, minimum 0.040 inch (1.0 mm) thick, unless otherwise indicated.

B. Metal Drip Edge: Brake-formed sheet metal with at least a 2-inch (50-mm) roof deck flange and a 1-1/2-inch (38-mm) fascia flange with a 3/8-inch (9.6-mm) drip at lower edge. Furnish the following material in lengths of 8 or 10 feet (2.5 to 3 m).
1. Material: Aluminum sheets.

C. Metal Flashing: Job-cut to sizes and configurations required.
1. Material: Aluminum sheets.

D. Open-Valley Metal Flashing: Preformed, inverted "V" profile at center of valley and extending at least 9 inches (230 mm) in each direction from centerline of valley. Select material from subparagraphs below.
   1. Material: Aluminum sheets.

E. Vent Pipe Flashing: Lead conforming to ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick, unless otherwise indicated. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof extending at least 4 inches (100 mm) from pipe onto roof.

2.4 ACCESSORIES

A. Felt Underlayment: Type I, 36-inch- (914-mm-) wide, 30#, asphalt-saturated organic felt, complying with ASTM D 226 (No. 15) or ASTM D 4869.

B. Waterproof Underlayment: Minimum 45-mil- (1-mm-) thick, self-adhering, polymer-modified, bituminous sheet membrane, complying with ASTM D 1970. Provide primer when recommended by underlayment manufacturer.

C. Ridge Vent: High-density polypropylene, nonwoven modified polyester, or other UV-stabilized plastic designed to be installed under asphalt shingles at ridge. Ridge vent shall be commercial size and grade and be compatible with roofing manufacturer’s requirements.

D. Nails: Aluminum or hot-dip galvanized steel, 0.120-inch- (3-mm-) diameter barbed shank, sharp-pointed, conventional roofing nails with a minimum 3/8-inch- (9.5-mm-) diameter head and of sufficient length to penetrate 3/4 inch (19 mm) into solid decking or at least 1/8 inch (3 mm) through plywood sheathing.

   1. Where nails are in contact with flashing, prevent galvanic action by providing nails made from the same metal as that of the flashing.

E. Staples: Minimum 0.0625-inch- (1.6-mm-) thick, zinc-coated, steel roofing staples with minimum crown width of 15/16 inch (23.8 mm), and of sufficient length to penetrate 3/4 inch (19 mm) into deck lumber or through plywood deck. Staples may only be used if allowed per manufacturer’s requirements for installation and warranty certification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate for compliance with requirements for substrates, installation tolerances, and other conditions affecting performance of asphalt shingles. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with noncorrosive roofing nails.

B. Coordinate installation with flashings and other adjoining work to ensure proper sequencing. Do not install roofing materials until all vent stacks and other penetrations through roof sheathing have been installed and are securely fastened against movement.

3.3 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations but not less than those recommended by ARMA's "Residential Asphalt Roofing Manual" or "The NRCA Steep Roofing Manual."
   1. Fasten asphalt shingles to roof sheathing with either roofing staples, applied pneumatically, or nails.

B. Felt Underlayment: Apply 1 layer of felt underlayment horizontally over entire surface to receive asphalt shingles, lapping succeeding courses a minimum of 2 inches (50 mm), end laps a minimum of 4 inches (100 mm), and hips and valleys a minimum of 6 inches (150 mm). Fasten felt with sufficient number of roofing nails or noncorrosive staples to hold underlayment in place until asphalt shingle installation.

   1. Apply an additional layer of felt underlayment on roof decks with a slope of 2 to 4 inches per foot (1:6 to 1:3).
   2. Omit felt underlayment at areas of waterproof underlayment. Lap felt underlayment over waterproof underlayment as recommended by manufacturer but not less than 2 inches (50 mm).

C. Waterproof Underlayment: Apply waterproof underlayment at eaves. Cover deck from eaves to at least 24 inches (600 mm) inside exterior wall line.

   1. In addition to eaves, apply waterproof underlayment in place of felt underlayment at valleys.

D. Flashing: Install metal flashing and trim as indicated and according to details and recommendations of the "Asphalt Roofing" section of "The NRCA Steep Roofing Manual" and ARMA's "Residential Asphalt Roofing Manual."

E. Install asphalt shingles, beginning at roof's lower edge, with a starter strip of roll roofing or inverted asphalt shingles with tabs removed. Fasten asphalt shingles in the desired weather exposure pattern; use number of fasteners per shingle as recommended by manufacturer and in accordance with IBC 200 for 110 mph wind zone conditions. Use vertical and horizontal chalk lines to ensure straight coursing.

   1. Cut and fit asphalt shingles at valleys, ridges, and edges to provide maximum weather protection. Provide same weather exposure at ridges as specified for roof. Lap asphalt shingles at ridges to shed water away from direction of prevailing wind.

2. Use fasteners at ridges of sufficient length to penetrate sheathing as specified.
3. Pattern: manufacturers standard or recommended shingle spacing offset at succeeding courses.

F. Ridge Vents: Install ridge vents according to manufacturer's instructions.

3.4 ADJUSTING

A. Replace any damaged materials installed under this Section with new materials that meet specified requirements.

PART 4 - QUANTITY AND PAYMENT

No separate payment will be made for work related to this item as outlined above. Include all such costs in with the unit/lump sum price(s) bid for the various related items scheduled in the Proposal.

END OF SECTION 073113

SECTION 074600 - VINYL SIDING, FASCIA AND SOFFIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preformed vinyl siding, trim, and accessories for facing exterior walls.

B. Preformed vinyl soffit panels, trim, and accessories for facing exterior roof overhangs, eaves and fascia.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood stud framing, furring, and sheathing for support of aluminum siding.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy (Galvannealed by the Hot Dip Process).

B. American Society for Testing and Materials (ASTM) D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supported Plastics in a Horizontal Position.

C. American Society for Testing and Materials (ASTM) D638 - Tensile Properties of Plastics.

D. American Society for Testing and Materials (ASTM) D3679 - Rigid Polyvinyl Chloride (PVC) Siding.

E. Underwriters Laboratories (UL) 94 - Test for Flammability of Plastic Materials.

F. Vinyl Siding Institute (VSI): Vinyl Siding Installation, a How-To Guide.

1.4 SUBMITTALS

A. Product Data : Manufacturer's data sheets on each product to be used, including:
   1. Material descriptions, dimensions, and profiles.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

B. Shop Drawings: Layout, dimensions, weatherproofing, penetrations, terminations, trim, and installation methods.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, 4 inches (102 mm) long minimum samples of siding and trim in selected finish and color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with a minimum of 10 years' successful experience manufacturing aluminum, steel and/or vinyl siding.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver siding in manufacturer's protective cartons and clearly labeled as to specific products contained.

B. During delivery and storage keep siding cartons flat and supported along entire length.

C. Store materials off ground, out of weather, in dry place. Provide ventilation. Protect from falling objects and construction activities.

1.7 WARRANTY

A. Upon Completion, provide a Lifetime limited, transferable warranty. In the case of siding purchased by, or installed upon property owned by or in part by corporations, government entities or agencies, religious organizations, trusts, condominium or corporate housing arrangements, intangible legal entities or any other entity or organization capable of an infinite life, the warranty period will be fifty (50) years following the installation of the siding.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Gentek Building Products, Inc.,

B. Substitutions: Or Equal

2.2 MATERIALS

A. PVC: Fabricate siding and trim from polyvinyl chloride (PVC) meeting ÅSTM D3679 requirements for compound class number 2 with the following properties:
   1. Tensile strength tested in accordance with ÅSTM D638: 6,700 PSI (46 MPa).
   2. Flexural strength tested in accordance with ÅSTM D790: 14,000 PSI (96 MPa).
   3. Modulus of elasticity tested in accordance with ÅSTM D638: 410,000 PSI (2827 MPa).
   4. Impact resistance tested in accordance with ÅSTM D256:
      a. At 32 degrees F (0 degrees C): 2.0 foot pounds per inch of notch.
      b. At 70 degrees F (21 degrees C): 3.6 foot pounds per inch of notch.
   5. Coefficient of linear thermal expansion tested in accordance with ASTM D696: (2.9 x 10 to the minus 5 inch/inch/degree F. (5.3 x 10 to the minus 5 mm/mm/degree C.)
   6. Deflection temperature when tested in accordance with ÅSTM D648 with 264 PSI (1820 kPa) load: 163 degrees F. (73 degrees C.)
   7. Average maximum burn distance tested in accordance with ÅSTM D635: 0.8 inch. (20 mm.)
   8. Average maximum burn time tested in accordance with ÅSTM D635: 5 seconds.
   9. Maximum ignition temperature tested in accordance with ÅSTM D1929:
      a. Flash ignition: 752 degrees F. (400 degrees C.).
      b. Self ignition: 860 degrees F. (460 degrees C).
   10. Flame spread tested in accordance with ÅSTM E84: 15 maximum.
   11. Smoke development tested in accordance with ÅSTM E84: 500 maximum.

12. Color: As selected from manufacturer's standard colors.

2.3 VINYL SIDING PANELS

A. Aurora: Double 4 inch Clapboard.
1. Dimensions: 8 inches (203 mm) exposed width by 150 inches (3810 mm) long with 1/2 inch (13 mm) butt and rolled edge nail hem.
2. Thickness: 0.040 inch (1.02 mm)
3. Surface finish: Embossed brushed texture.
4. Color: As selected from manufacturer's standard colors.

2.4 VINYL SOFFIT PANELS

A. Fairweather Soffit: Triple 4 Inch.
1. Dimensions: 12 inches (305 mm) exposed width by 144 inches (3658 mm) long.
2. Thickness: 0.040 inch (1.02 mm).
3. Profile: V-grooves forming three panels and all panels provided with vent perforations.
4. Net free open area: 5.8 square inches per linear foot (123 square cm per meter).
5. Color: As selected from manufacturer's standard colors.

2.5 TRIM

A. Standard Accessories:
1. Consistent with shape, size, and properties shown on the drawings and as required for complete installation.
2. Produced from the same compound materials and with comparable properties as the siding.
3. Color: Matching or color coordinated with siding.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm that all critical dimensions are as specified on the drawings

B. Beginning installation indicates Installer's acceptance of substrate as suitable to accept siding and soffits.

3.2 PREPARATION

A. Repair substrate flaws or defects before applying siding or soffits.

B. Where necessary, fur surfaces to an even plane and free from obstructions before application.

3.3 INSTALLATION

A. Install vinyl siding and vinyl soffits in accordance with the latest edition of "Vinyl Siding Installation Manual," published by the Vinyl Siding Institute (VSI) and special details from the drawings.

B. Install aluminum and steel siding products in accordance with manufacturers printed installation manual.

C. Install siding, soffits, and accessories in accordance with best practice, with all joint members plumb and true.

3.4 FIELD QUALITY CONTROL

A. After installation of siding and soffits, check entire surface for obvious flaws or defects.

B. Replace and repair any problem areas, paying close attention to the substrate for causes of the problem.

3.5 CLEANING AND PROTECTION

A. After application of siding and soffits, clean as necessary to remove all fingerprints and soiled areas.

B. Upon completion of siding application, clean entire area, removing all scrap, packaging, and unused materials related to this work.

4.01 QUANITY AND PAYMENT

Include all costs for material and labor for complete installations of the Vinyl Siding, Fascia, Soffit and Trim in the lump sum price bid for the related item of work as listed in the bid form.

END OF SECTION 074600

SECTION 077100 - GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Gutters and Downspouts.

B. Related Accessories.

1.2 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. SMACNA - Architectural Sheet Metal Manual.

1.3 DESIGN / PERFORMANCE REQUIREMENTS

A. Conform to applicable code for size and method of rain water discharge.

B. American Architectural Manufacturers Association (AAMA) Specification 1405.1 "Specification for Aluminum Raincarrying Systems".

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog data, detail sheets, and specifications.

B. Shop Drawings: Prepared specifically for this project; showing dimensions of metal gutters and accessories, fastening details and connections and interface with other products.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Manufacturers warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

B. Installer Qualifications: Certified and approved installer of the sheet metal roofing manufacturer.

C. Perform Work in accordance with SMACNA Manual

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products to prevent twisting, bending, and abrasion, and to provide ventilation. Slope stored materials to drain.

C. During storage prevent contact with materials capable of causing discoloration, staining, or other damage.

1.7 PROJECT CONDITIONS

A. Coordinate installation with installation of adjacent roofing, siding and related materials.

1.8 WARRANTY

A. Provide the Manufacturer's Limited 20-Year, pro-rated and non-transferable Warranty covering labor materials.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed underlayment and membrane materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Mazmet Metal Products, which is located at: 1050 Bristol Road; Mountainside, NJ 07092; Phone: 908.654.7686; Fax: Fax: 908.654.7898;

B. Substitutions: Approved equal.

2.2 COMPONENTS

A. Gutters: Aluminum sheet, ASTM B 209, Alloy 3105-H24. Minimum tensile strength 26,000 psi, minimum yield strength 25,000 psi or equivalent. Continuous and seamless sheet aluminum, roll formed.
   1. Thickness:
      a. 0.063 inch

B. Downspouts: Aluminum sheet, ASTM B 209, Alloy 3105-H24. Minimum tensile strength 26,000 psi, minimum yield strength 25,000 psi or equivalent.
   1. Thickness:
      a. 0.063 inch
   2. Size:
      a. Match Existing : 4 inches by 4 inches (min.).

C. Endcaps: Aluminum sheet, ASTM B 209, Alloy 3105-H24, thickness 0.063 inch

D. Inside and Outside Mitres: Aluminum sheet, ASTM B 209, Alloy 3105-H24, thickness 0.063inch

E. Gutter Hangers and Anchors: Aluminum sheet, ASTM B 209, Alloy 3105-H24, thickness 0.063 inch. Provide types required to suit project requirements.

F. Downspout Anchors: Aluminum. Provide types required to suit project requirements.

G. Elbows: Aluminum sheet, ASTM B 209, Alloy 3105-H24. Minimum tensile strength 26,000 psi, minimum yield strength 25,000 psi or equivalent.
   1. Thickness:

a. 0.063 inch
2. Size: To match downspouts.

H. Aluminum Finish: Kynar 500 system factory applied in a continuous process in a single operation.
1. Color:
a. Approved by Owner from Manufacturer’s Standard Colors.

I. Sealant: As recommended by manufacturer.

J. Fasteners: Same material and finish as gutters and downspouts.

2.3 FABRICATION

A. Continuously form seamless gutters to the profiles and sizes specified.

B. Form downspouts of profiles and sizes specified.

C. Hem exposed edges of metal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify governing dimensions at building.

C. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Clean and repair if necessary any adjoining work on which this work is in any way dependent for its proper installation.

C. 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 in accordance with manufacturer's instructions.

B. Install gutters using appropriate hangers to allow normal expansion and contraction.

C. Install gutter hangers using two 1-1/4 inch (32 mm) screw shank nails and fastened into solid lumber.

D. All gutters shall be in continuous length for each elevation (run). No end laps are allowed.

E. Exercise care in placing aluminum in contact with other dissimilar metals or materials that are not compatible with aluminum.

F. Providing adequate insulation/separation where ever necessary, such as by painting or otherwise protecting when they are in contact with aluminum or when drainage from them

passes over aluminum surfaces.

G. Install sealants where indicated to clean dry surfaces only without skips or voids.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

PART 4 MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all furnishment and installation of all gutters, downspouts, and appurtenances.

END OF SECTION 077100

SECTION 081100 - STEEL SECTIONAL OVERHEAD GARAGE DOOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This section includes sectional overhead doors, as follows:

1. Steel frame and steel panels.
2. Manual chain operated door openers.
3. Electric Operated door openers.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract.

B. Product data, roughing-in diagrams, and installation instructions for each type and size of overhead door. Include manufacturer's operating instructions and maintenance data.

C. Shop drawings for special components and installations which are not fully dimensioned or detailed in manufacturer's data.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide each sectional overhead door as a complete unit produced by a single manufacturer, including frames, sections, brackets, guides, tracks, counterbalance mechanisms, hardware, operators, and installation accessories.

B. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry for unit installation. Provide setting drawings, templates, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

C. See concrete and masonry Sections for instruction on installing inserts and anchorage devices.

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. C.H.I. Overhead Doors
2. Clopay Overhead Door Co.
3. Raynor Garage Door Co.
4. Wayne/Dalton Corp.
5. Overhead Door Corp.

6. Raynor Garage Door Co.
7. Atlas Roll-Lite Overhead Doors.
8. Or Equal

B. Overhead door shall be Model 3285 as manufactured by C.H.I. Overhead Doors, or equal.

2.2 STEEL SECTIONS

A. Construct door sections from galvanized, structural-quality carbon steel sheets complying with ASTM A 446 (ASTM A 446M), Grade A, or ASTM A 526 (ASTM A 526M), with a minimum yield strength of 33,000 psi (225 Mpa), and a minimum G40 (Z180) zinc coating complying with ASTM A 525 (ASTM A 525M).

1. Interior Steel Sheet Thickness: 27 gauge
2. Exterior Steel Sheet Thickness: 26 gauge
3. Exterior Section Face: Wood grain textured

B. Fabricate sections from a single sheet to provide units not more than 24 inches (600 mm) high, and nominally 2 inches (50 mm) deep. Roll horizontal meeting edges to a continuous shiplap, rabbeted, or keyed weather seal, with a reinforcing flange return.

C. Enclose open section with 0.06-inch (1.5-mm) galvanized steel channel, end stiles welded in place. Provide intermediate stiles, cut to door section profile, spaced at not more than 48 inches (1200 mm) o.c. and welded in place.

D. Reinforce bottom section with a continuous channel or angel conforming to bottom section profile.

E. Reinforce sections with continuous horizontal and diagonal reinforcing, as required by door width and design wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth, and bolted or welded in place.

F. Insulate inner core of steel sections with manufacturer’s standard glass-fiber, polystyrene, or polyurethane-foam type insulation. Average R-Value of 8.72.

1. Enclose insulation with manufacturer’s standard steel sheet secured to door panel.

G. Finish door sections as follows:

1. Apply manufacturer’s standard prime and finish coats, applied to interior and exterior door faces. The finish color shall be selected by the owner from standard color samples.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Provide manufacturer’s standard, galvanized-steel track system, sized for door size and weight, and designed for clearances shown. Track size shall be 3 inches wide minimum. Provide complete track assembly including brackets, bracing and reinforcing for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches (50 mm) o.c. for door-drop safety device. Slope tracks at

proper angle from vertical, or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

B. Track Reinforcement and Supports: Provide galvanized-steel track reinforcement and support members. Secure, reinforce and support tracks as required for size and weight of door to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

C. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling tracks) with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

D. Weather Seals: Provide continuous rubber, neoprene, or flexible vinyl adjustable weather-strip gasket at tops and compressible astragal on bottoms of each overhead door.

1. In addition, provide continuous flexible seals at door jamb edges for a fully weathertight installation.

E. Vision Panels: Provide vision panels in arrangement shown. Set glass in rubber or neoprene channel glazing compound for wood doors, as required. Provide removable stops of same material at door section frames.

F. Exhaust Outlets: Provide exhaust pipe outlets through doors as shown on elevation plans.

2.4 HARDWARE

A. General: Provide heavy-duty, rust-resistant hardware, with galvanized or cadium-plated or stainless steel fasteners, to suit type of door.

B. Hinges: Provide heavy steel hinges at each end stile and at each intermediate stile, per manufacturer's recommendations for size of door. Attach hinges to door section through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet (4.87 m) in width, unless otherwise recommended by door manufacturer.

C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide roller tires to suit size of track [3-inch (75-mm) diameter for 3-inch (75-mm) track]; and as follows:

1. Case-hardened steel tires for normal installations.
2. Neoprene or bronze tires for hazardous atmospheres.

D. Pull Handles, Locks and Latches: For manually operated doors, furnish lifting handles, locks and locking device as follows:

1. Lifting Handles: Galvanized steel.
2. Locking Bars: Single side, operable from inside and outside.

E. Fabricate locking device assembly with mortise lock, spring-loaded dead bolt, chromium-plated operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

2.5 COUNTERBALANCING MECHANISM

A. Extension Spring: Operation by extension-spring counterbalance mechanism with aircraft-type steel cable over ball-bearing sheaves. Provide oil-tempered, wired springs with interal safety rods. Combine operation with a spring bumper in each horizontal track to cushion door at end of opening operation.

B. Torsion Spring: Operation by torsion-spring counterbalance mechanism, consisting of adjustable-tension, tempered-steel torsion springs mounted a cross header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables. Provide springs calibrated for 10,000 cycles minimum.

C. Provide cast-aluminum or grey-iron casting cable drums, grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet (4.87 m) long and two additional (4.87 m) long, unless closer spacing recommended by door manufacturer.

D. Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 DOOR OPERATION

A. Provide electric operated door opening operators. Provide ZAP Model 8800 motor controller, or equal, for all garage doors. The system shall be provided with case mounted open, stop, & close buttons, full system safety control, adjustable auto-close timer, & sockets for optional remote control receiver. Electrical contractor shall provide all wiring in accordance with manufacturer's requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports according to shop drawings, manufacturer's instructions, and as specified.

B. Fasten vertical track assembly to framing at not less than 24 inches (600 mm) o.c. Hang horizontal track from structural overhead framing with angle or channel hangers, welded and bolt-fastened in place. Provide sway bracing, diagonal bracing, and reinforcing as required for rigid installation of track and door-operating equipment.

C. After completing installation, including work by other trades, lubricate, test, and adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Cost for work specified in this section shall be paid for under the bid form line items for which they are a part. Costs shall include all furnishment and installation of all overhead doors as required per the contract Documents.

END OF SECTION 081100

SECTION 082000 - FIBERGLASS REINFORCED PLASTIC DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

The Contractor shall provide fiberglass reinforced plastic (FRP) doors and fiberglass resin transfer molded door frames; complete in place wherever a door location is shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Qualifications of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Engineer.

B. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance

B. Basis of Acceptance: The manufacturer's recommended installation procedures, when approved by the Engineer, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

C. Source limitations: Obtain fiberglass reinforced plastic doors and resin transfer molded fiberglass frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames. This ensures complete uniformity of physical properties and consistency in the resin chemistry tailored for this application. Glass for windows in doors shall also be furnished and installed by door and frame manufacturer

1.03 REFERENCE STANDARDS

Test certification by an independent and accredited laboratory is required for the properties listed in this section. Reports shall be made available upon request for each of the standards and certifications described below.

A. Door Properties:

1) Standard test method for steady state thermal transmission properties by means of the heat flow meter apparatus.
2) Successfully completed 1,000,000 cycles test in accordance with: AAMA 920-03 – Specification for Operating Cycle Performance of Side-Hinged Exterior Door Systems. ANSI A250.4-2001 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings. NWWDA TM-7 Test Method to Determine the Physical Endurance of Wood Doors and Associated Hardware Under Accelerated Operating Conditions.

B. Laminate Properties:

Door face plate is a minimum of 0.125 inch thick fiberglass reinforced plastic molded into one continuous sheet starting with a 25 mil resin-rich gelcoat layer resin integrally molded with multiple layers of 1.5 oz. sq ft fiberglass mat and one layer of 18 oz per square yard fiberglass woven roving saturated with special resin. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass resin.
Laminated plate by itself evaluated in accordance with Florida Building Code TAS 201 Large Missile Impact Test as per ASTM-1996-05b, Standard Specification for Performance of Exterior Windows, Curtain Wall, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.

1) ASTM D 638 Tensile Strength Properties of Plastic
2) ASTM D 790 Flexural Strength Properties of Plastic
3) ASTM D 2583 Indention Hardness of Plastics
4) ASTM D 256 Izod Pendulum Impact Resistance
5) ASTM D 792 Density/Specific Gravity Of Plastics
6) ASTM D 1761 Mechanical Properties of Fasteners
7) ASTM E 84 Surface Burning Characteristics of Materials
8) ASTM G 155 Xenon Light Exposure of Non Metallic Materials
9) ASTM D 635 Method For Rate of Burning
10) ASTM D 2843 Smoke Density
11) ASTM D 1929 Self Ignition Temperature Properties
12) SFBC PA 201 Impact Procedures for Large Missile Impact

C. Core Properties:

1) ASTM C 177 Thermal Properties of Materials
2) ASTM D 1622 Density and Specific Gravity
3) ASTM E 84 Surface Burning Characteristics of Materials
4) WDMA TM-10 and TM-5 Firestop ASTM E 152 U.L 10(b)
5) ASTM E90-04- Sound Transmission Loss
6) ASTM E413-04- Classification for Rating Sound Insulation
7) ASTM E1332-90- Standard Classification for Determination of Outdoor-Indoor Transmission Class
8) ASTM E2235-04- Standard Test for Determination of Decay Rates for Use in Sound Insulation Methods

1.04 SUBMITTALS

A. Product Data: Manufacturer's descriptive literature and installation instructions.

B. Shop Drawings: Illustrations and schedule of door and frame sizes, types, materials, construction, finishing, anchoring, accessories, and preparation for installing hardware.

D. Certificates: Manufacturer's certificates that materials meet specification requirements.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Shipment: Each door and frame shall be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate shall contain all fasteners necessary for installation as well as complete installation instructions.

B. Deliver material in manufacturer's original packaging on edge, out of inclement weather for protection against the elements with all tags and labels intact and legible.

C. Store and handle material in such manner as to avoid damage; store at site under cover on wood blocking or on suitable floors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fiberglass doors and frames shall be products of the following manufacturers or equivalent, subject to compliance with specification requirements:

1. Chem-Pruf Door Co.
2. Approved Equivalent.

B. All work of this section shall be the products of a single manufacturer.

2.02 FABRICATION

Surfaces shall be smooth and free from warp or buckles. Arrises shall be straight, sharp and out of wind. Assemble joints so that the intersection will be imperceptible when finished.

2.03 FRP DOORS

A. Doors shall be made of fiberglass reinforced plastic (FRP) using Class 1 premium resin with no fillers that is specifically tailored to resist chemicals and contaminants typically found in environment for which these specifications are written. Doors shall be 1 ¾ inch thick and of flush construction, having no seams or cracks. For consistency in the resin chemistry tailored for this application and to maintain the same physical properties throughout the structure, all fiberglass components including face plates, stiles and rails and frames must be fabricated by the same manufacturer. Components obtained through various outside sources for plant assembly will not be accepted.

B. Door Plates shall be 0.125 inch thick minimum, molded in one continuous piece, starting with 25 mil gelcoat of the color specified, integrally molded with multiple layers of 1.5 ounces per square foot fiberglass mat and one layer of 18 ounce per square yard fiberglass woven roving. Each layer shall be individually laminated with resin as mentioned above. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass to resin. Plate alone to withstand Large Missile Impact per FBC TAS 201. Face plates manufactured using the pultrusion process does not allow for a smooth molded gelcoat finish, the use of woven roving for adequate plate thickness, strength and weight, or the appropriate glass to resin ratio and will not meet the quality standards of this project.

C. Stiles and Rails shall be constructed starting from the outside toward the inside, with a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints and disparate materials used to form the one-piece stile and rail.

D. Core material shall be Polypropylene plastic honeycomb core with a non woven polyester veil for unparalleled plate bonding, 180 PSI typical compression range unless otherwise requested.

E. Internal Reinforcement shall be #2 SPF of sufficient amount to adequately support required hardware and function of same.

F. Finish of door frame shall be identical with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture resulting in a smooth gloss surface that is dense and non-porous. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat results in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

G. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Fiberglass retainers, which hold the glazing in place, shall be resin transfer molded with a profile that drains away from glazing. The window retainer must match the color and finish of the door plates with 25 mil of resin-rich gelcoat integrally molded in at time of manufacture. Mechanical fasteners shall not be used to attach retainers. Glass, as specified herein, shall be furnished and installed by door and frame manufacturer. In order to maintain uniform appearance, product longevity and the corrosion resistance this application requires, window retainers fabricated from Metal, PVC or Vinyl will not be accepted.

H. Louver openings shall be completely sealed so that the interior of the door is not exposed to the environment. Louvers are to be solid fiberglass “V” Vanes and shall match the color and finish of the door plates.

I. Transoms shall be identical to the doors in finish, construction, materials, thickness and reinforcement.

2.04 FRP FRAMES

A. Frames (rated and non-rated) shall be fiberglass and manufactured using the resin transfer method creating one solid piece (no voids) with complete uniformity in color and size. Beginning with a minimum 25 mil gelcoat layer molded in and a minimum of two layers of continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core material of 2 psf polyurethane foam. Metal frames or pultruded fiberglass frames will not be accepted.

B. Finish of frame shall be identical to the door with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat result in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

C. Jamb/Header connection shall be mitered for tight fit.

D. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware. Reinforcing material shall be a dense matrix of cloth glass fibers and premium resin with a minimum hinge screw holding value of 1000 lbs per screw. All reinforcing materials shall be completely encapsulated. Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.

E. Mortises for hardware shall be accurately machined by CNC to hold dimensions to +/- 0.010 inch in all three axis.

F. Hinge pockets shall be accurately machined by CNC to facilitate heavy duty hinges at all hinge locations, using shims when standard weight hinges are used.

2.05 HARDWARE REINFORCING

A. Minimum Hardware Reinforcing Gauges listed below. All gauges to be U. S. Standard:

1. Hinges - 1-3/4" - Frame 7 gauge - Door 7 gauge
2. Mortise Locksets and Deadlocks - Door 14 gauge frame 14 gauge
3. Bored or Cylindrical Locks - Door 14 gauge - Frame 14 gauge
4. Flush Bolts and Chain and Foot Bolts - Door 14 gauge - Frame 14 gauge
5. Surface Applied Closers - Door 12 gauge - Frame 12 gauge
6. Hold-Open Arms - Door 12 gauge - Frame 12 gauge
7. Push and Pull Plates & Bars - Door 16 gauge except when thru bolts are used
8. Surface Panic Devices - Door 14 gauge - Frame 14 gauge
9. Floor Checking Hinges - Door 7 gauge - Frame 7 gauge

2.06 HARDWARE SCHEDULE

A. The special nature of this material requires that all related hardware as specified must be furnished and installed by the door frame manufacturer to maintain product quality and function as well as to ensure sufficient support/reinforcement, precision tooling and proper sealing methods are provided. The following is the minimum hardware required per door:

1. 4 1/2” X 4 1/2” Stainless Steel Butt Hinges with non- removable pins and ball bearings (3 hinges per door)

2. Heavy Duty Cylindrical Type Schlage “D” Series Lockset or equal. Provide a minimum of three keys per lock - final key shall be same as existing GCUA keys. Contractor must use a construction lock set during construction.

3. Kickplates - brushed aluminum inside and out.

4. Door stops - brush aluminum.

5. Door closer with hold open arm.

6. Panic devices on all exit doors from building.

7. Wall bumpers

8. Thresholds caulked with approved mastic.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Contractor shall verify openings are correctly prepared to receive doors and frames.

B. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.

3.01 WARRANTY

Provide lifetime guarantee on all fiberglass doors and frames against failure due to corrosion. Additionally, fiberglass doors and fiberglass frames shall also be guaranteed for ten years against failure due to materials and workmanship, including warp, separation or delamination, and expansion of the core.

PART 4 – QUANTITY AND PAYMENT

No separate payment will be made for work related to fiberglass doors, frames and related appurtenances as outlined above. Include all such costs in with the related items as shown in the Proposal for which it is a part.

END OF SECTION 082000

SECTION 083300 - OVERHEAD COILING SERVICE DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section includes Overhead Coiling Service Doors.

1. Interior mounted, insulated, coiling door with hood; motor operator and manual operator, including all tracks and miscellaneous hardware for a complete installation.

B. Related Sections: Other specification sections which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 055000: Miscellaneous Metals

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each type of coiling door. Include both published data and any specific data prepared for this project. Provide exploded view of doors with all materials of construction identified.

B. Shop Drawings: Submit shop drawing for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

C. Name manufacturer's authorized representative who will supervise the installation.

D. Certify door, hood and all appurtenances can be successfully installed based on dimensions provided.

1.04. QUALITY ASSURANCE

A. Manufacturer: Coiling Service Doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of rolling doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past five years.

B. Installer: Installation of rolling doors shall be supervised on-site by an authorized representative of the manufacturer.

C. Single-Source Responsibility: Provide doors, guides, motors, and related primary components from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.05 WARRANTY

A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3

years or 20,000 cycles, whichever occurs first.

B. PowderGuard Finish
1. PowderGuard Max: Applied to curtain, guides, bottom bar, headplates: Manufacturer's limited Max Finish warranty for 5 years.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Provide rolling doors by Overhead Door Corporation, or equal.

2.02 ROLLING DOORS

A. Trade Model Number: 625 Series Stormtite Insulated Service Doors by Overhead Door Corporation or equal.

B. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

1. Flat profile type F-265I for doors up to 40´0" wide. Slats shall be fabricated as follows:
-Front Slats: 20 gauge galvanized steel.
-Back Slats: 24 gauge galvanized steel.

2. Slat cavity shall be filled with CFC-free foamed-in- place, polyurethane insulation.

C. Finish:

1. Galvanized Steel Materials: Slats and hood shall be galvanized steel in accordance with ASTM A 525 and receive rust-inhibitive, roll coating process, including bonderizing, 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on powder coated top coat. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

D. Color: Powder coating finish, PowderGuard Max or equal, in color as selected by Owner from manufacturer's standard colors.

E. Windload Design: 20 PSF.

F. Weatherseals: Provide vinyl bottom seal and internal hood seals, interior guide seals, lintel seals and, where applicable, exterior guide seals and interior guide seals.

G. Bottom Bar: Two angles; minimum thickness 1/8" bolted back to back to reinforce curtain in the guides.

H. Guides: Three structural angles with minimum thickness of 3/16". Guides shall be weatherstripped with a vinyl weather seal at each jamb, on the exterior and interior curtain side.

I. Brackets: Hot rolled material to support counterbalance, curtain and hood.

J. Counterbalance: Helical torsion spring type designed for standard 100,000 cycle life design. Counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 per foot of span. Counterbalance shall be adjustable by means of an adjusting tension wheel.

K. Hood: Galvanized steel, 24 gauge with intermediate supports as required. Provide with internal hood baffle weatherseal. Hood flanges shall be accessible and turned under hood.

L. Electric Motor Operator and Controls

1. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
   a. Sensing Edge Protection:
      1) Pneumatic sensing edge.
   b. Operator Controls:
      1) Push-button operated control stations with open, close, and stop buttons.
      2) Key operation with open, close, and stop controls.
      3) Push-button and key operated control stations with open, close, and stop buttons.
      4) Controls for both interior and exterior location.
      5) Controls surface mounted.
   c. Motor Voltage: 115/230 single phase, 60 Hz.

M. Manual Operation: Chain hoist.

N. Locking: Interior slide bolt lock.

O. Wall Mounting Condition: Face-of-wall mounting.

PART 3 - EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Strictly comply with manufacturers installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

B. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

C. Grind block surface to produce a directly vertical installation with minimal gap between block and guide. All grinding shall be limited to the outside dimensions of the guides. Neatly inject all weather silicone caulk material (minimum 20 year warranty) of an identical color to block between guide and block.

3.03 ADJUSTING AND CLEANING

A. Test rolling doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

4.01 QUANTITY AND PAYMENT

No separate payment shall be made for rolling doors. Include all costs in the appropriate proposal bid item.

END OF SECTION 088300

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Material: aluminum windows as on the drawings and specified in this section. All windows to include full height insect screens.

B. Installation: labor, tools, and material needed to install aluminum windows.

C. Glass and glazing.

1.02 REFERENCES

A. AAMA - American Architectural Manufacturers Association

1. AAMA/NWWDA 101/I.S.2-97 “Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors”
2. AAMA 502-02 "Voluntary Specification for Field Testing of Windows and Sliding Glass Doors"
3. AAMA 611-98 "Voluntary Specification for Anodized Architectural Aluminum"
4. AAMA 701-04 "Voluntary Specification for Pile Weatherstripping"
5. AAMA 800-92 "Voluntary Specifications and Test Methods for Sealants"
6. AAMA 902-99 “Voluntary Specification for Sash Balances”
7. AAMA 910-93 “Voluntary ‘Life Cycle’ Specifications and Test Methods for Architectural Grade Windows and Sliding Glass Doors”
8. AAMA 1503-98 "Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections"
9. AAMA 2603-02 “Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels”
10. AAMA 2604-02 “Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels”
11. AAMA 2605-02 “Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels”
12. AAMA CW-10-04 "Care and Handling of Architectural Aluminum from Shop to Site"

B. ASTM - American Society for Testing and Materials

1. ASTM E 283-04 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"
2. ASTM E 330-02 "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference"
3. ASTM E 331-00 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference"
4. ASTM E 2190-02 "Standard Specification for Insulating Glass Unit Performance and Evaluation"

C. NFRC – National Fenestration Rating Council: NFRC 100-04 “Procedure for Determining Fenestration Product U Factors”

1.03 SYSTEM DESCRIPTION

A. AAMA Designation: H-AW50.

B. Windows: 4-1/2" frame depth; extruded aluminum with integral structural polyurethane thermal break in the frame and sash members; equal-leg frame; finish factory-applied; frames and sash factory-assembled.

C. Configuration: double hung; sash side load for removal, after removing the sash caps and carrier plates with a Phillips driver, and retracting the balance carriers with a slotted driver; bevel sash.

D. Sash glazing: exterior tape; 1" insulating glass; silicone heel bead; interior EPDM gasket; interior aluminum glazing bead; glass description in paragraph 2.04; factory-glazed.

1.04 PERFORMANCE REQUIREMENTS

A. Conformance to H-AW50 specifications in AAMA/NWWDA 101/I.S.2-97 when tests are performed on the prescribed 5'0" x 8'0" minimum test size with the following test results:

1. Air Infiltration: after the AAMA 910-93 life cycle test, maximum .16 cfm/square foot when tested per ASTM E 283-04 at a static air pressure difference of 6.24 psf.
2. Water Penetration: after the AAMA 910-93 life cycle test, no uncontrolled water leakage when tested per ASTM E 331-00 at a static air pressure difference of 10 psf.
3. Uniform Deflection: no more than L/175 when tested per ASTM E 330-02 at a static air pressure difference of 50 psf.
4. Uniform Structural: window to be operable, and maximum .2% permanent deformation per member when tested per ASTM E 330-02 at a static air pressure difference of 75 psf.

B. Thermal testing per AAMA 1503.1-88, at the prescribed 4'0" x 6'0" test size glazed with 1” insulating glass made with 1/8” clear and 1/8” hard coat low E lites and argon gas, with the following test results:

1. Condensation Resistance Factor: minimum 49 frame and 61 glass CRF.
2. Thermal Transmittance: maximum .57 BTU/HR/SQ.FT/F U value.

C. Thermal computer simulation testing per NFRC 100-04, at the prescribed 48" x 72" Non-Residential Size, glazed with 1” insulating glass made with 1/8” clear and 1/8” soft coat low E lites and argon gas: Thermal Transmittance to be maximum .54 BTU/HR/SQ.FT/F U value.

1.05 SUBMITTALS

A. Shop drawings: window location chart; typical window elevations; details of assemblies, hardware, and glazing details for factory-glazed units.

B. Product data: manufacturer's specifications and test reports from an AAMA-accredited laboratory.

C. Samples: each specified finish for aluminum; other samples as requested.

1.06 QUALITY ASSURANCE

A. Furnish a valid AAMA “Notice of Product Certification” indicating that the windows for the project conform to AAMA/NWWDA 101/I.S.2-97.

B. Furnish visible, permanent IGCC certification labels indicating conformance to ASTM E 2190-02 on double insulating glass units.

C. Manufacturer's warranties:

1. Windows: warrant for one year against defects in material or workmanship under normal use.
2. Insulating glass units: warrant seal for five years against visual obstruction from film formation or moisture collection between internal glass surfaces, excluding that caused by glass breakage or abuse.
3. Paint finish: Duracron™ organic finish conforming to AAMA 2603-02: warrant for five years against chipping, peeling, or cracking.

1.07 DELIVERY, STORAGE, AND HANDLING - Handle and protect windows and accessories in accordance with AAMA CW-10-04 until project completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. TRACO TR-9900 Double Hung Side Load Thermal Aluminum Window

B. Other acceptable manufacturers who have demonstrated a successful history of manufacturing for 5 years equivalent products:

2.02 MATERIALS

A. Aluminum extrusions: produced from commercial quality 6063-T5 alloy; free from defects impairing strength and durability.

B. Hardware: white bronze pole-operated automatic head lock; white bronze automatic sill lock and keeper, one set per window under 45" wide, two sets on wider windows.

C. Weatherstrip: secured in extruded ports; double rows on sash perimeters: rigid PVC weatherseal in one side of the vertical stiles, and pile conforming to AAMA 701-04 with polypropylene center fin in remaining locations.

D. Balances: Class 5 heavy duty spring conforming to AAMA 902-99, of same design as used in the AW ‘Life Cycle’ test, and of appropriate capacity to hold sash stationary and permit smooth operation.

E. Insect screens: full; held in exterior track with stainless steel leaf springs and sill automatic latches; 7/16" x 1-1/4" x .045" extruded tubular aluminum frame with finish to match window in color and performance; corners mitered, gusset reinforced, and crimped; 18 x 16 dark fiberglass mesh; PVC spline.)

2.03 FABRICATION

A. Frame: head and sill coped and fastened to jambs with three stainless steel screws per frame corner; corners factory-sealed with sealant conforming to AAMA 800-92.

B. Water control: two sill weep slots to allow water to drain by gravity and resist wind-driven water; sash weep holes.

C. Sash: tubular horizontal sash rails coped and fastened to vertical sash stiles with a telescope-design joint secured with two stainless steel screws per sash corner; corners factory-sealed with sealant conforming to AAMA 800-92.

D. Sash design: continuous extruded pull-down rail on top sash exterior and lift rail on bottom sash interior; mechanical meeting rail interlock.

2.04 DOUBLE INSULATING GLASS UNITS

A. Performance

1. Dual-seal durability: conformance to ASTM E 2190-02; visible, permanent IGCC certification label.

B. Exterior glass lite

1. Thickness: 1/8".
2. Tint: clear.
3. Type: annealed.

C. Interior glass lite

1. Thickness: 1/8".
2. Tint: clear.
3. Type: annealed.

2.05 FINISH ON ALUMINUM EXTRUSIONS

A. Application: on clean extrusions free from serious surface blemishes; on exposed surfaces visible when installed product's operating sash are closed.

B. Coating: PPG Duranar™ with resin containing 70% fluoropolymer; thermosetting; alternative finishes will not be acceptable.

C. Quality standard: conforming to AAMA 2605-02, including 10 years Florida exposure and 4000 hours humidity tests.

D. Pretreatment: five-stage; zinc chromate conversion coating.

E. Application: electrostatic spray and oven bake by approved applicator.

F. Coating quantity: minimum one primer coat and one color coat.

G. Dry film thickness: minimum 1.2 mils on exposed surfaces, except inside corners and channels.

H. Color: chosen from manufacturer's standards.

2.06 INSTALLATION ACCESSORIES

A. Material: extruded aluminum; nominal .062” wall; with exposed surfaces finished to match window color and finish performance; concealed fasteners; required weatherseals; designed for unrestricted expansion and contraction.

B. Exterior: wrap around panning, sill cover.

C. Interior: two-piece snap trim.

PART 3 - EXECUTION

3.01 PREPARATION - Prepare openings to be in tolerance, plumb, level, provide for secure anchoring, and in accordance with approved shop drawings.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's recommendations and approved shop drawings with skilled craftspeople.

B. Provide required support and securely fasten and set windows plumb, square, and level without twist or bow.

C. Apply sealant per sealant manufacturer's recommendations at joints, wipe off excess, and leave exposed sealant surfaces clean and smooth.

3.03 ADJUSTING AND CLEANING - Adjust windows as necessary for smooth and weathertight operation, and leave windows clean and free of construction debris.

PART 4 – QUANTITY AND PAYMENT

Include all costs for material and labor for complete installation of the Windows in the lump sum price bid for the related item of work as listed in the bid form.

END OF SECTION 085113

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Plumbing demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish**:** Polished chrome-plated

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete and reinforcement as specified in Division 03 Sections.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220500

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

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.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL 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. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. 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.

3. 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-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

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 grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6. Galvanized-steel wall sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve seal.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve seal.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 : Galvanized-steel wall sleeves with sleeve seal.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve seal.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6 : Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of 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 type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
    h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
    j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
    k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

2. Escutcheons for Existing Piping:

    a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.

g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

B. Related Sections:
1. Division 21 fire-suppression piping Sections for fire-protection pressure gages.
2. Division 22 Section " Domestic Water Piping" for water meters inside the building.

1.3 SUBMITTALS

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

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. 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, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 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 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Palmer Wahl Instrumentation Group.
    e. REOTEMP Instrument Corporation.
    f. Trerice, H. O. Co.
    g. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Sealed type, drawn steel 5-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

    a. Ashcroft Inc.
    b. Miljoco Corporation.
    c. REOTEMP Instrument Corporation.

B. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Marsh Bellofram.
    d. Miljoco Corporation.
    e. Palmer Wahl Instrumentation Group.

f. REOTEMP Instrument Corporation.
g. Trerice, H. O. Co.
h. Weiss Instruments, Inc.
i. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.
3. Case: Sealed type, drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel
10. Connector Type(s): Union joint, bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of 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 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, provide products by one of the following:

      a. Flo Fab Inc.
      b. Miljoco Corporation.
      c. Palmer Wahl Instrumentation Group.
      d. Tel-Tru Manufacturing Company.
      e. Trerice, H. O. Co.
      f. Weiss Instruments, Inc.
      g. Winters Instruments - U.S.

   2. Standard: ASME B40.200.

2.4 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.
   4. Material for Use with Steel Piping: CRES.
   5. Type: Stepped shank unless straight or tapered shank is indicated.
   6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
   7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
   8. Bore: Diameter required to match thermometer bulb or stem.
   9. Insertion Length: Length required to match thermometer bulb or stem.
   10. Lagging Extension: Include on thermowells for insulated piping and tubing.
   11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. AMETEK, Inc.; U.S. Gauge.
      b. Ashcroft Inc.
      c. Ernst Flow Industries.
      d. Flo Fab Inc.
      e. Marsh Bellofram.

f. Miljoco Corporation.
g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of.

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, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Ernst Flow Industries.
d. Flo Fab Inc.
e. Marsh Bellofram.
f. Miljoco Corporation.
g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; drawn steel; 4-1/2-inch nominal diameter with back 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 and kPa.
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.

2.6 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 ½, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS ¼ or NPS ½ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.8 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish two test-plug kit(s) containing two thermometer(s), 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.

C. 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.

D. 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.

E. 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 .

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.9 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Archon Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Brooks Instrument.
4. Ernst Co., John C., Inc.
5. Ernst Flow Industries.
6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
7. OPW Engineered Systems; a Dover company.
8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

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: 125 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 a minimum of 2 inches into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install 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 THERMOMETER SCHEDULE

1. Liquid-filled bimetallic-actuated type.
2. Compact Industrial-style, liquid-in-glass type.
3. Direct-mounted, light-activated type.
4. Test plug with EPDM self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

C. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

D. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

E. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F and 0 to 150 deg C.

F. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

G. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

H. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi and 0 to 600 kPa.

B. Scale Range for Water Service Piping: 0 to 160 psi and 0 to 1100 kPa.

C. Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.

D. Scale Range for Domestic Water Piping: 0 to 100 psi and 0 to 600 kP.

E. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

F. Scale Range for Domestic Water Piping: 0 to 200 psi and 0 to 1400 kP.

G. Scale Range for Domestic Water Piping: 0 to 300 psi and 0 to 2500 kPa.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220519

SECTION 220523 - 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. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Iron ball valves.
5. Iron, single-flange butterfly valves.
6. Iron, grooved-end butterfly valves.
7. Bronze lift check valves.
8. Bronze swing check valves.
9. Iron swing check valves.
10. Iron swing check valves with closure control.
11. Iron, grooved-end swing check valves.
12. Iron, center-guided check valves.
13. Iron, plate-type check valves.
14. Bronze gate valves.
15. Iron gate valves.
16. Bronze globe valves.
17. Iron globe valves.
18. Lubricated plug valves.
19. Chainwheels.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

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: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

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 angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug 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 and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

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.

2.2 BRASS BALL VALVES

A. One-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Grinnell Corporation.
e. Jamesbury, Inc.
f. NIBCO INC.
g. Watts Industries, Inc.; Water Products Div.
h. Kitz Corporation.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

B. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jomar International, LTD.
b. Kitz Corporation.
c. Marwin Valve; a division of Richards Industries.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Conbraco Industries, Inc.; Apollo Div.
f. Grinnell Corporation.
g. Jamesbury, Inc.
h. NIBCO INC.
i. PBM, Inc.

2. Controls Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.

d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Dover Corp.; Dover Resources Company; Norriseal Div.
i. Flo Fab Inc.
j. Grinnell Corporation
k. Hammond Valve.
l. Kitz Corporation.
m. Legend Valve.
n. Milwaukee Valve Company.
o. Mueller Steam Specialty; a division of SPX Corporation.
p. NIBCO INC.
q. Norriseal; a Dover Corporation company.
r. Red-White Valve Corporation.
s. Spence Strainers International; a division of CIRCOR International.
t. Sure Flow Equipment Inc.
u. Tyco International, Ltd.; Tyco Valves & Controls.
v. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.

e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.4 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
d. Crane Co.; Crane Valve Group; Flowseal.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Hammond Valve.
h. Jamesbury; a subsidiary of Metso Automation.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Process Development & Control, Inc.
l. Tyco Valves & Controls; a unit of Tyco Flow Control.
m. Xomox Corporation.

2. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 285 psig at 100 deg F.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

2.5 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following] [available manufacturers:

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 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.6 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following vailable manufacturer:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Grinnell Corporation.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Industries, Inc.; Water Products Div.
k. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following vailable manufacturers:

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. Cincinnati Valve Company
e. Flomatic Valves
f. Grinnell Corporation
g. Hammond Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

2.8 BRONZE GATE VALVES

A. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. Hammond Valve.
b. Kitz Corporation.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Powell Valves.
f. Red-White Valve Corporation.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. American Valve, Inc.
i. Grinnell Corporation.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.

e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron bronze, or aluminum.

2.9 IRON GATE VALVES

A. Class 250, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Cincinnati Valve Company
e. Grinnell Corporation

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Grinnell Corporation

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.

c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

2.10 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to butterfly valve stems.
3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

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 chainwheels on operators for butterfly and gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. 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.

G. Provide an additional six (6) valves of each type and size used in the project to accommodate interferences and/or as directed by Engineer.

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, use the following:

1. Shutoff Service: Ball, butterfly or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: ball, or butterfly valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.
    c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP 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 Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: may be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One or Three piece, full port, brass with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, NRS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, stainless-steel disc.
2. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, EPDM seat, stainless-steel disc.
3. High-Performance Butterfly Valves: Class 150, single flange.
4. Iron Swing Check Valves: Class 250, metal seats.
5. Iron Gate Valves: Class 250, NRS or OS&Y.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass and Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One or Three piece, full port, brass with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, [NRS, bronze.

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, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, stainless-steel disc.
3. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, EPDM seat, stainless-steel disc.
4. High-Performance Butterfly Valves: Class 150, single flange.
5. Iron Swing Check Valves: Class 250, metal seats.
6. Iron Gate Valves: Class 250, NRS or OS&Y.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related Sections:
1. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.
2. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

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.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

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: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel .

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of 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 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel
7. Metallic Coating: Electroplated zinc

2.5 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 552, Type II cellular glass with 100-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.

2.6 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.

2.7 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.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.8 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.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 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. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

I. 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.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. 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.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. 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.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. 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.

Q. 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 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. 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.

3.6 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 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. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 .
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24 requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 requiring clamp flexibility and up to 4 inches of insulation.
4. 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.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
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.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. 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.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restraining braces.

1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: 2009.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: 2009.

a. Component Importance Factor: as required by IBC 2009.
b. Component Response Modification Factor: as required by IBC 2009.
c. Component Amplification Factor: as required by IBC 2009.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): as required by IBC 2009.
4. Design Spectral Response Acceleration at 1-Second Period: as required by IBC 2009.

1.4 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and licensed in the State of New Jersey.

C. Welding certificates.

D. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.

5. Kinetics Noise Control.

6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.

8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

G. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127 and NFPA 13.

2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION 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. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. 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.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in 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. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White

C. Background Color: Red

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. 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. Valve-tag schedule shall be included in operation and maintenance data.

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: 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. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting".

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping(Label piping as CWS, HWS, HWR):

   a. Background Color: White
   b. Letter Color: Blue

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Black
   b. Letter Color: White

3. Compressed Air Piping:

   a. Background Color: White
   b. Letter Color: Green

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 2 inches , round
   b. Hot Water: 2 inches , round

2. Valve-Tag Color:

   a. Cold Water: Green

b. Hot Water: Green

3. Letter Color:

a. Cold Water: White
b. Hot Water: White

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Calcium silicate.
b. Cellular glass.
c. Flexible elastomeric.
d. Mineral fiber.
e. Phenolic.
f. Polyisocyanurate.
g. Polyolefin.
h. Polystyrene.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

B. Related Sections include the following:
1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sample Sizes:

a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2 .
b. Sheet Form Insulation Materials: 12 inches square.
c. Jacket Materials for Pipe: 12 inches long by NPS 2 .
d. Sheet Jacket Materials: 12 inches square.
e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

    a. One 10-foot section of NPS 2 straight pipe.
    b. One each of a 90-degree threaded, welded, and flanged elbow.
    c. One each of a threaded, welded, and flanged tee fitting.
    d. One NPS 2or smaller valve, and one NPS 2-1/2 or larger valve.
    e. Four support hangers including hanger shield and insert.
    f. One threaded strainer and one flanged strainer with removable portion of insulation.
    g. One threaded reducer and one welded reducer.
    h. One pressure temperature tap.
    i. One mechanical coupling.

2. Equipment Mockups: One tank or vessel.
3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Obtain Architect's approval of mockups before starting insulation application.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

8. Demolish and remove mockups when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following

    a. Cell-U-Foam Corporation; Ultra-CUF.
    b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000(Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 3 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Insulco, Division of MFS, Inc.; Triple I.

b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has 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. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content in compliance with 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; Encacel.
b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
c. Marathon Industries, Inc.; 570.
d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-10.
    b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    d. Marathon Industries, Inc.; 550.
    e. Mon-Eco Industries, Inc.; 55-50.
    f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76.
    b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.
    f. Vimasco Corporation; 750.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76-8.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White 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.

4. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Factory cut and rolled to size.

b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-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 2-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.

D. 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. Products: Subject to compliance with requirements, provide one of the following:

a. Pittsburgh Corning Corporation; Pittwrap.
b. Polyguard; Insulrap No Torch 125.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches .
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches .
3. Thickness: 6.5 mils .
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    b. Compac Corp.; 130.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    d. Venture Tape; 1506 CW NS.

2. Width: 2 inches .
3. Thickness: 6 mils .
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    b. Compac Corp.; 120.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches .
3. Thickness: 3.7 mils .
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches
3. Film Thickness: 6 mils
4. Adhesive Thickness: 1.5 mils
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209 , Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

2. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

3. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch , aluminum according to ASTM B 209 , Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch , stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Provide an additional one hundred feet of preformed insulation and fifty square feet of blanket and board type insulation as well as accessories and labor for each size, thickness and type used on the project to accommodate any changes required to resolve interferences or as directed by the Engineer.

J. Install insulation with least number of joints practical.

K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at 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.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

a. Do not weld anchor pins to ASME-labeled pressure vessels.
b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
d. Do not overcompress insulation during installation.
e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
f. Impale insulation over anchor pins and attach speed washers.
g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum, at least 0.060 inch thick.

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch , and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch 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; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

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 o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.11 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by the Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to ten location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to ten locations of straight pipe, ten locations of threaded fittings, ten locations of welded fittings, five locations of threaded strainers, five locations of welded strainers, five locations of threaded valves, and five locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.13 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Domestic water pump insulation shall be the following:
1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

D. Domestic chilled-water (potable) pump insulation shall be the following:
1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

E. Domestic hot-water pump insulation shall be the following:
1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

F. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be the following:
1. Mineral-Fiber Pipe and Tank: 2 inches thick.

G. Domestic hot-water storage tank insulation shall be the following, of thickness to provide an R-value of 12.5:
1. Mineral-fiber pipe and tank.

H. Domestic water storage tank insulation shall be the following:
1. Mineral-Fiber Pipe and Tank: 2 inches thick.

I. Domestic chilled-water (potable) storage tank insulation shall be the following:
   1. Mineral-Fiber Pipe and Tank: 2 inches thick.

J. Piping system filter-housing insulation shall be the following:
   1. Mineral-Fiber Pipe and Tank: 2 inches thick.

3.14 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.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

   1. NPS 1 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

   2. NPS 1-1/4 and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

   1. NPS 1-1/4 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

   2. NPS 1-1/2 and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

C. Domestic Chilled Water (Potable):

   1. All Pipe Sizes: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

D. Stormwater and Overflow:

   1. All Pipe Sizes: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

H. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1- inch thick.

I. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

J. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I or II: 1-1/2 inches thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.17 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.

B. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

C. Chilled Domestic Water, All Sizes: Cellular glass, 2 inches thick.

3.18 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
1. Paper & Foil with Vapor Retarder

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches :
1. PVC 30 mils thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches :
1. Painted Aluminum Smooth 0.032 inch thick.

F. Piping, Concealed:
1. Paper & Foil with Vapor Retarder

G. Piping, Exposed:
1. PVC 30 mils thick

3.19 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
   1. Aluminum, Smooth 0.040 inch thick.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches :
   1. Aluminum, Smooth 0.040 inch thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches
   1. Aluminum, Smooth 0.040 inch thick.

F. Piping, Concealed:
   1. Aluminum, Smooth 0.040 inch thick.

G. Piping, Exposed:
   1. Aluminum, Smooth 0.040 inch thick.

3.20 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.
5. Water meters furnished by utility company for installation by Contractor.
6. Water meters.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

B. Performance Requirements: Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Service Piping: 160 psig.
2. Domestic Water Distribution Piping: 125 psig.

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings. 220553 - 1
3. Dielectric fittings.
4. Flexible connectors.
5. Water meters.
6. Backflow preventers and vacuum breakers.

7. Water penetration systems.

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.
3. Compressed air piping.
4. HVAC equipment.

D. Field quality-control reports.

1.5 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.

1.6 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. Do not proceed with interruption of water service without Architect's, Construction Manager's, Engineers and Owner's written permission.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. 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. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Tube.

C. Material: High-density, cross-laminated PE film of 0.004-inch minimum thickness.

D. Color: Black.

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.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following.

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Dresser Piping Specialties.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc; a Sensus company.
g. Viking Johnson; c/o Mueller Co.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. Charlotte Pipe and Foundry Company.
b. Harvel Plastics, Inc.
c. Spears Manufacturing Company.

2. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket[or threaded] end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. Colonial Engineering, Inc.
b. NIBCO INC.
c. Spears Manufacturing Company.

2. Description: CPVC or PVC four-part union. Include brass[or stainless-steel] threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

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, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. EPCO Sales, Inc.
    d. Hart Industries International, Inc.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    f. 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, provide products by one of 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 minimum.
    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, provide products by one of 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, provide products by one of 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.

2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld, Inc.
5. Hyspan Precision Products, Inc.
6. Mercer Rubber Co.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. Tozen Corporation.
10. Unaflex, Inc.
11. Universal Metal Hose; a Hyspan company

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.9 WATER METERS

A. Displacement-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AALIANT; a Venture Measurement Product Line.
b. ABB.
c. Badger Meter, Inc.
d. Carlon Meter.
e. Mueller Company; Water Products Division.
f. Schlumberger Limited; Water Division.
g. Sensus Metering Systems.

2. Description:

a. Standard: AWWA C700.
b. Pressure Rating: 150-psig working pressure.
c. Body Design: Nutating disc; totalization meter.
d. Registration: In gallons or cubic feet as required by utility.

e. Case: Bronze.
f. End Connections: Threaded.

B. Turbine-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AALIANT; a Venture Measurement Product Line.
b. ABB.
c. Badger Meter, Inc.
d. Hays Fluid Controls.
e. Master Meter, Inc.
f. McCrometer.
g. Mueller Company; Water Products Division.
h. Schlumberger Limited; Water Division.
i. SeaMetrics Inc.
j. Sensus Metering Systems.

2. Description:

a. Standard: AWWA C701.
b. Pressure Rating: 150-psig working pressure.
c. Body Design: Turbine; totalization meter.
d. Registration: In gallons or cubic feet as required by utility company .
e. Case: Bronze.
f. End Connections for Meters NPS 2 and Smaller: Threaded.
g. End Connections for Meters NPS 2-1/2 and Larger: Flanged.

C. Compound-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB.
b. Badger Meter, Inc.
c. Master Meter, Inc.
d. Mueller Company; Water Products Division.
e. Schlumberger Limited; Water Division.
f. Sensus Metering Systems.

2. Description:

a. Standard: AWWA C702.
b. Pressure Rating: 150-psig working pressure.
c. Body Design: With integral mainline and bypass meters; totalization meter.
d. Registration: In gallons or cubic feet as required by utility company.
e. Case: Bronze.

f. Pipe Connections: Flanged.

D. Fire-Service-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Badger Meter, Inc.
b. Mueller Company; Water Products Division.
c. Schlumberger Limited; Water Division.
d. Sensus Metering Systems.

2. Description:

a. Standard: AWWA C703 and UL listing.
b. Pressure Rating: 175-psig working pressure.
c. Body Design:

1) Proportional, Detector-Type Water Meters: With meter on bypass.

a) Bypass Meter: AWWA C701, turbine or AWWA C702, compound type with bronze case; size not less than one-half nominal size of main-line meter.

2) Turbine-Type Water Meters: With strainer, and with meter on bypass.

a) Strainer: Full size, matching water meter.
b) Bypass Meter: AWWA C701, turbine type with bronze case; not less than NPS 2.

d. Registration: In gallons or cubic feet as required by utility company.
e. Case: Bronze.
f. Pipe Connections for Meters NPS 2 and Smaller: Threaded.
g. Pipe Connections for Meters NPS 2-1/2 and Larger: Flanged.

E. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

F. Remote Registration System: Encoder type complying with AWWA C707; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 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 underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

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 "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. 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.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping adjacent to equipment and specialties to allow service and maintenance.

N. Install piping to permit valve servicing.

O. 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.

P. Install piping free of sags and bends.

Q. Provide an additional one hundred feet of piping and accessories and labor for each size of pipe used on the project to accommodate any changes required to resolve interferences or as directed by the Engineer.

R. Install fittings for changes in direction and branch connections.

S. Install PEX piping with loop at each change of direction of more than 90 degrees.

T. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

U. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

V. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

W. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

X. 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."

Y. 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."

Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 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. 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.

3.4 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 2-1/2 and 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 balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 and Smaller: Fitting-type coupling.
2. NPS 2 and Larger: Sleeve-type coupling.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation and install water meters according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6, utility company's requirements, and the following:

D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

E. Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

F. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

G. Install fire-service water meters with shutoff valves on water-meter inlet and outlet and on full-size valved bypass around meter. Support meter, valves, and piping on brick or concrete piers.

H. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.9 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.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

J. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

K. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

L. Install hangers for vertical PEX piping every 48 inches.

M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

N. Install supports for vertical PVC piping every 48 inches.

O. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 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. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. Equipment: Cold- and hot-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.

3.11 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.

3.12 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.

3.13 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.14 CLEANING

A. Clean and disinfect potable and non-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. Clean non-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 procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.15 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.

1. Underground Domestic Water piping materials shall match those used for the underground site main to the building Soft copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings and brazed joints.

D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.

E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.

F. Aboveground domestic water piping, NPS 5 to NPS 8, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.

G. Underground Domestic Water piping materials shall match those used for the underground site main to the building:

3.16 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 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: [Calibrated] [Memory-stop] balancing valves.
4. 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.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. FEBCO; SPX Valves & Controls.
e. Rain Bird Corporation.
f. Toro Company (The); Irrigation Div.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Plumbing Products Group; Wilkins Div.

3. Standard: ASSE 1001.

4. Size: NPS 1/4 to NPS 3, as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: Rough bronze or Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Arrowhead Brass Products, Inc.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. Legend Valve.
    e. MIFAB, Inc.
    f. Prier Products, Inc.
    g. Watts Industries, Inc.; Water Products Div.
    h. Woodford Manufacturing Company.
    i. Zurn Plumbing Products Group; Light Commercial Operation.
    j. Zurn Plumbing Products Group; Wilkins Div.

3. Standard: ASSE 1011.
4. Body: Bronze, nonremovable, with manual drain.
5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
6. Finish: Chrome, nickel plated or rough bronze.

C. Pressure Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Toro Company (The); Irrigation Div.
    f. Watts Industries, Inc.; Water Products Div.
    g. Zurn Plumbing Products Group; Wilkins Div.

4. Standard: ASSE 1020.

5. Operation: Continuous-pressure applications.
6. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
7. Accessories:

    a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.
    c. Woodford Manufacturing Company.
    d. Zurn Plumbing Products Group; Wilkins Div.

3. Standard: ASSE 1035.
4. Size: NPS 1/4 or NPS 3/8 matching faucet size.
5. Body: Bronze.
6. End Connections: Threaded.
7. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.

3. Standard: ASSE 1056.
4. Operation: Continuous-pressure applications.
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Industries, Inc.; Water Products Div.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Industries, Inc.; Water Products Div.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; [cast iron with interior lining complying with AWWA C550 or that is FDA approved] [steel with interior lining complying with AWWA C550 or that is FDA approved] [stainless steel] for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; [flanged] <Insert type> for NPS 2-1/2 and larger.

7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow-Preventer Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1047 and FMG approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved].
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
    c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Double-Check, Detector-Assembly Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1048 and FMG approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
    b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

E. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Flomatic Corporation.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Honeywell Water Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.

6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CLA-VAL Automatic Control Valves.
    b. Flomatic Corporation.
    c. OCV Control Valves.
    d. Watts Industries, Inc.; Ames Fluid Control Systems.
    e. Watts Industries, Inc.; Watts ACV.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

    a. Pattern: Angle or Globe-valve design
    b. Trim: Stainless steel.

5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Industries; Bell & Gossett Div.
    d. NIBCO INC.
    e. TAC Americas.
    f. Taco, Inc.
    g. Watts Industries, Inc.; Water Products Div.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Brass or bronze,

4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Industries; Bell & Gossett Div.
    d. NIBCO INC.
    e. TAC Americas.
    f. Watts Industries, Inc.; Water Products Div.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. Hammond Valve.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Cash Acme.
    c. Conbraco Industries, Inc.
    d. Honeywell Water Controls.
    e. Legend Valve.
    f. Leonard Valve Company.
    g. Powers; a Watts Industries Co.
    h. Symmons Industries, Inc.
    i. Taco, Inc.
    j. Watts Industries, Inc.; Water Products Div.
    k. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Chrome plated or Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.

    a. Armstrong International, Inc.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company.
    d. Powers; a Watts Industries Co.
    e. Symmons Industries, Inc.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig.
5. Type: Exposed-mounting, thermostatically controlled water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded inlets and outlet.
8. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
10. Pressure Drop at Design Flow Rate: 15 psig.
11. Valve Finish: Chrome plated or Rough bronze.
12. Piping Finish: Copper.

C. Manifold, Thermostatic, Water-Mixing-Valve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Leonard Valve Company.
    b. Powers; a Watts Industries Co.
    c. Symmons Industries, Inc.

2. Description: Factory-fabricated, exposed-mounting, thermostatically controlled, water-mixing-valve assembly in three-valve parallel arrangement.
3. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
4. Intermediate-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
5. Small-Flow Parallel: Thermostatic water mixing valve.
6. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
7. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
8. Component Pressure Ratings: 125 psig minimum, unless otherwise indicated.
9. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.
10. Unit Pressure Drop at Design Flow Rate: 15 psig.
11. Thermostatic Mixing Valve and Water Regulator Finish: Chrome plated or rough bronze.
12. Piping Finish: Copper.

D. Individual-Fixture, Water Tempering Valve:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Honeywell Water Controls.
    d. Lawler Manufacturing Company, Inc.
    e. Leonard Valve Company.
    f. Powers; a Watts Industries Co.
    g. Watts Industries, Inc.; Water Products Div.
    h. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.

7. Finish: Rough or chrome-plated bronze.

E. Primary Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Heat-Timer Corporation.
   b. Holby Valve Co., Inc.

2. Standard: ASSE 1017, thermostatically controlled tempering valve, listed as tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze.
5. Temperature Control: Manual.
6. Inlets and Outlet: Threaded.
7. Valve Finish: Rough bronze.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller;flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

   a. StrainersNPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.125 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.7 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Acorn Engineering Company.
   b. Guy Gray Manufacturing Co., Inc.

c. IPS Corporation.
d. LSP Products Group, Inc.
e. Oatey.
f. Plastic Oddities; a division of Diverse Corporate Technologies.
g. Symmons Industries, Inc.
h. Watts Industries, Inc.; Water Products Div.
i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
j. Zurn Plumbing Products Group; Light Commercial Operation.

2. Mounting: Recessed.
3. Material and Finish: Stainless-steel box and faceplate.
4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.
b. IPS Corporation.
c. LSP Products Group, Inc.
d. Oatey.
e. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.
3. Material and Finish: Stainless-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE STATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARCHON Industries, Inc.
2. Armstrong International, Inc.

3. Cooney Brothers, Inc.
4. DynaFluid Ltd.
5. Leonard Valve Company.
6. Strahman Valves, Inc.
7. T & S Brass and Bronze Works, Inc.

B. Single-Temperature-Water Hose Stations:

1. Standard: ASME A112.18.1.
2. Cabinet: Stainless-steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
3. Hose-Rack Material: Stainless steel.
4. Body Material: Bronze with stainless-steel wetted parts.
5. Body Finish: Rough bronze or chrome plated.
6. Mounting: Wall, with reinforcement.
7. Supply Fitting: NPS 3/4 gate, globe, or ball valve and check valve and NPS 3/4 copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet long.
9. Nozzle: With hand squeeze on-off control.
10. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

C. Hot- and Cold-Water Hose Stations:

1. Standard: ASME A112.18.1.
2. Type Faucet: Blending valve.
3. Cabinet: Stainless-steel enclosure with exposed valve handles, hose connection, and hose rack. Include thermometer in front.
4. Hose-Rack Material: Stainless steel.
5. Body Material: Bronze with stainless-steel wetted parts.
6. Body Finish: Rough bronze or chrome plate.
7. Mounting: Wall, with reinforcement.
8. Supply Fittings: TwoNPS 3/4 gate, globe, or ball valves and check valves and NPS 3/4 copper, water tubing. Omit check valves if check stops are included with fitting.
9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet long.
10. Nozzle: With hand squeeze on-off control.
11. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze, Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Prier Products, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Woodford Manufacturing Company.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.

9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

2.11 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 Valve:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 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.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.12 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. PPP Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Tyler Pipe; Wade Div.
    h. Watts Drainage Products Inc.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: Metal Bellows, see fixture schedule.
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.13 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 or NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.

6. Inlet and Vent Outlet End Connections: Threaded.

2.14 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. MIFAB, Inc.
    b. PPP Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts Industries, Inc.; Water Products Div.

3. Standard: ASSE 1018.
4. Pressure Rating: 125 psig minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

3. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
4. Size: NPS 1-1/4 minimum.
5. Material: Chrome-plated, cast brass.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. PPP Inc.

2. Standard: ASSE 1044,
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Recessed-mounting steel box with stainless-steel cover.

5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Six.
8. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers 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 not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each control valve,water pressure-reducing valve, solenoid valve and pump].

H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

I. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install shutoff valve on outlet if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

J. Install ground hydrants with [1 cu. yd.] <Insert dimension> of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

K. Install draining-type post hydrants with [1 cu. yd.] <Insert dimension> of crushed gravel around drain hole. Set post hydrants in concrete paving or in [1 cu. ft.] <Insert dimension> of concrete block at grade.

L. Install nonfreeze, nondraining-type post hydrants set in concrete or pavement.

M. Install freeze-resistant yard hydrants with riser pipe set in concrete or pavement. Do not encase canister in concrete.

N. Install water hammer arresters in water piping according to PDI-WH 201.

O. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

P. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Q. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

R. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check backflow-prevention assemblies.
4. Dual-check-valve backflow preventers.
5. Double-check, detector-assembly backflow preventers.
6. Water pressure-reducing valves.
7. Calibrated balancing valves.
8. Primary, thermostatic, water mixing valves.
9. Manifold, thermostatic, water-mixing-valve assemblies.
10. Primary water tempering valves.
11. Outlet boxes.
12. Hose stations.
13. Supply-type, trap-seal primer valves.
14. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Any sanitary piping located above a drop ceiling or within a wall adjacent to an occupied space is to be insulated cast iron.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Coordination Drawings: Plans and details, drawn to scale, on which above and below ground sanitary and vent piping is shown and coordinated with other installations, using input from installers of the items involved. Clearly indicate all inverts and coordinate with site contractors.

D. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

2.5 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.

2.6 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Gaskets: Lip seals shaped to fit socket groove, with plastic backup ring.

1. Material: EPDM, unless NBR is indicated.

2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.

B. Form: Sheet.

C. Color: Black.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings heavy-duty shielded, couplings; and hubless-coupling joints.

C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

D. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

E. Aboveground, vent piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

G. Underground, soil and waste piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Provide an additional one hundred feet of drainage and vent piping for each size used on the project to resolve interferences or as directed by the Engineer.

G. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A 674 or AWWA C105.

H. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

I. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

J. Install underground, ductile-iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

L. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

M. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

N. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

O. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

P. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

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."

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

K. Install supports for vertical stainless-steel piping every 10 feet.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Trench drains.
   4. Air-admittance valves.
   5. Roof flashing assemblies.
   6. Through-penetration firestop assemblies.
   7. Miscellaneous sanitary drainage piping specialties.
   8. Flashing materials.
   9. Grease interceptors.
   10. Grease removal devices.
   11. Oil interceptors.
   12. Solids interceptors.

B. Related Sections include the following:

   1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, and catch basins.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
   1. Grease interceptors.
   2. Grease removal devices.
   3. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

   1. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that interceptors andaccessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.
      f. Josam Company; Blucher-Josam Div.

   2. Standard: ASME A112.36.2M for cast iron & ASME A112.3.1 for stainless steel for cleanout test tee.
   3. Size: Same as connected drainage piping
   4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
   5. Closure: Countersun brass plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   7. Closure: Stainless-steel plug with seal.
   8. See plumbing fixture schedule for additional requirements

B. Metal Floor Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Light Commercial Operation.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
      g. Josam Company; Josam Div.

   2. Standard: ASME A112.36.2M for cleanout.
   3. Size: Same as connected branch.
   4. Closure: Brass plug with straight threads and gasket
   5. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
   6. Standard: ASME A112.3.1.
   7. Size: Same as connected branch.
   8. Housing: Stainless steel.
   9. Closure: Stainless steel with seal.
   10. Riser: Stainless-steel drainage pipe fitting to cleanout.
   11. See plumbing fixture schedule for additional requirements

C. Cast-Iron Wall Cleanouts
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.

   2. Standard: ASME A112.36.2M. Include wall access.
   3. Size: Same as connected drainage piping.
   4. Body: As required to match connected piping.
   5. Closure: Countersunk brass plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
   8. Wall Access: Round stainless-steel wall-installation frame and cover.
   9. See plumbing fixture schedule for additional requirements

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Light Commercial Operation.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.

   2. Standard: ASME A112.6.3.
   3. Body Material: See Fixture Schedule.
   4. Seepage Flange: See Fixture Schedule
   5. Anchor Flange: See Fixture Schedule.
   6. Clamping Device: See Fixture Schedule.
   7. Outlet: Bottom
   8. Trap Pattern: Deep-seal P-trap
   9. See plumbing fixture schedule for additional requirements

2.3 TRENCH DRAINS

A. Trench Drains
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.

   2. Standard: ASME A112.6.3 for trench drains.
   3. Material: Ductile or gray iron.
   4. Outlet: See drawings
   5. See plumbing fixture schedule for additional requirements

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.

B. Description: Lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

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

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.6 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. 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.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Caps

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Frost-Resistant Vent Terminals

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

H. Expansion Joints

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.7 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. thickness.
2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Anchor grease interceptors and solids interceptors to concrete bases.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping where noted. 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.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

I. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

L. Install fixture air-admittance valves on fixture drain piping.

M. Install stack air-admittance valves at top of stack vent and vent stack piping.

N. Install air-admittance-valve wall boxes recessed in wall.

O. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

P. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

Q. Install through-penetration firestop assemblies in plastic at floor penetrations.

R. Assemble open drain fittings and install with top of hub 2 inches above floor.

S. Install deep-seal traps on floor drains and other waste outlets, if indicated.

T. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

U. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

V. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

W. Install vent caps on each vent pipe passing through roof.

X. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

Y. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Z. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

AA. Install cleanout immediately downstream from all interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

BB. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Oil interceptors.
   2. Sand/Sediment interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.7 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.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain oil and sand interceptors.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 221319

SECTION 223401 – FUEL-FIRED, DOMESTIC WATER HEATERS

1.1 RELATED DOCUMENTS

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

B. The plumbing equipment schedules.

1.2 SUMMARY

A. This Section includes the following for domestic water systems:

1. Light Commercial, High Efficiency, Gas-Fired Water Heaters.
2. Accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring.

C. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.

D. Coordination Drawings: Plans and details, drawn to scale, on which the location of the water heater, drain pan, drain piping, and intake and vent piping is shown and coordinated with other installations, using input from installers of the trades involved.

E. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ANSI Compliance: Provide gas water heaters that comply with ANSI standards for gas water heaters and related products and that bear AGA certification label.

E. ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

F. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:

1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
2. ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings," for household water heaters.

1.5 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period. See General Conditions specification section for requirements of special extended 1 year warranty for water heater from date of issuance of Certificate of Occupancy.

1. Failures include storage tanks and burner assemblies.
2. Warranty Period: From date of Substantial Completion:

a. Storage Tanks: 5 years (min.).
b. Burner Assemblies/Heat Exchangers: One year (min.)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Light Commercial, High Efficiency, Tube Type Gas-Fired Water Heaters:

    a. Lochinvar Corp.
    b. Bradford White
    c. Patterson-Kelley Co.

2. Expansion Tanks:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Zurn Industries, Inc.; Wilkins Div.

2.2 LIGHT COMMERCIAL, HIGH EFFICIENCY GAS WATER HEATERS

A. Description: Comply with UL 795 and ANSI Z21.13; include storage tank, circulator, piping, and controls.

B. Water Heater: Enclosed, insulated unit with controls.

1. Construction: According to ASME Boiler and Pressure Vessel Code: Section IV with 160-psig working-pressure rating.
2. Heat Exchanger: Copper, finned tube with bronze or glass-lined cast-iron headers. There shall be no bolts, gaskets, or “O” rings in the header configuration. Heat exchanger shall be hydrostatically tested to 240 psig. The heat exchanger shall be equipped with an outlet thermometer to monitor discharge water temperature.
3. Burner: High-temperature stainless steel construction, for use with tube-type water heaters and natural-gas fuel capable of 100% “On/Off” operation.

    a. Combustion Air Chamber: The combustion air chamber shall be sealed and enclosed in ceramic fiberboard insulation. A flame observation port shall be provided. A combustion air blower shall be provided to control fuel/air mixture.
    b. Automatic Ignition: Intermittent electronic ignition complying with ANSI Z21.20.
    c. Gas Valve: Main combination gas valve shall have redundant seats and a built-in low gas pressure regulator. The gas pressure regulator shall be referenced to the combustion air fan.
    d. Safety Controls: Automatic, high-temperature-limit cutoff device or system, a combination low air and blocked flue pressure switch to monitor fan operation, and an ASME temperature/pressure relief valve.

4. Control Panel: Provide with master power switch, (4) four ignition control LED lights to indicate sequential operation and diagnostics on control sensed malfunctions, low voltage transformer, and terminal strip for field connection of remote devices/controls. All components shall be easily accessed and serviceable from the front of the jacket through the control panel cover.

5. Temperature Controls: Standard immersion type operating aquastat with high limit control.

6. Draft Hood: Heater jacket design shall allow single unit venting connection without the use of external draft hood devices.

C. Hot-Water Storage Tank: Connected with piping to circulator and water heater.

1. Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
c. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
d. Jacket: Steel, with enameled finish.
e. ASME temperature/pressure relief valve.

2. Anode Rods: Factory installed, magnesium.
3. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

D. Mounting: Water heater, tank, and accessories factory mounted and provided as a single unit.

E. Circulator: UL 778, all bronze, in-line, centrifugal, single-stage, radially split case design, with mechanical seals; with 125-psig-minimum working-pressure rating and 225 deg F continuous water temperature. See equipment schedule for additional requirements.

F. Piping: Manufacturer's standard copper tubing.

2.3 EXPANSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

B. Construction: Working-pressure rating.

C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

E. Tank Exterior Finish: Manufacturer's standard, unless finish is indicated.

F. Air-Charging Valve: Factory installed.

2.4 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: According to the following:

1. Gas Water Heaters: ANSI Z21.22, combination temperature and pressure relief valve.

B. Vacuum Relief Valves: According to the following:

1. Gas Water Heaters: ANSI Z21.22.
2. Exception: Omit if water heater has integral vacuum-relieving device.

C. Gas Shutoff Valves: ANSI Z21.15, manually operated. Furnish for installation in piping.

D. Gas Pressure Regulators: ANSI Z21.18, appliance type, factory or field installed. Include pressure rating, capacity, and pressure differential required for water heater and gas supply.

E. Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

F. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch-high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1, pipe thread.

G. Water Heater Stands: Water heater manufacturer's factory-fabricated, steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.

H. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS ¾.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on stand, bracket, suspended platform, or directly to the floor.

B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install and connect gas water heaters according to NFPA 54.

1. Install appliance, gas pressure regulators on gas-burner inlets of water heaters without pressure regulators.
2. Install vent piping from gas-train pressure regulators and valves to outside of building where required. Terminate vent piping with brass-screened vent cap fitting. Do not combine vents except with approval of authorities having jurisdiction.

D. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

E. Install vacuum relief valves in cold-water-inlet piping.

F. Install water heater drain piping as indirect waste to spill into open drains or over floor drains.

G. Install thermometers on water heater inlet and outlet piping. Refer to Division 15 Section "Meters and Gages" for thermometers.

H. Install pressure gages on water heater piping. Refer to Division 15 Section "Meters and Gages" for pressure gages.

I. Arrange for insulation on equipment and piping not furnished with factory-applied insulation.

J. Fill water heaters with water.

K. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.

D. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection.

E. Make connections with dielectric fittings where piping is made of dissimilar metal.

F. Gas, Water Heater Vent Connections: Connect to vent system. Include draft hoods and diverters where required. Use vents same size as or larger than water heater outlets, but not smaller than indicated unless smaller vent size has been calculated according to NFPA 54. Comply with gas utility requirements for sizing. Gas vents are specified in Division 15 Section "Breechings, Chimneys, and Stacks."

G. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.

H. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to perform startup service.

B. In addition to manufacturer's written installation and startup checks, perform the following:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment and retest until satisfactory results are achieved.
2. Verify that piping system tests are complete.
3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping.
5. Check operation of circulators.
6. Test operation of safety controls, relief valves, and devices.

7. Energize electric circuits.
8. Adjust operating controls.
9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F unless piping system application requires higher temperature.
10. Balance water flow through manifolds of multiple-unit installations.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Owner's maintenance personnel on procedures for starting and stopping troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review date in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 223401

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

B. Related Sections include the following:

1. Provide plumbing fixtures in accordance with the fixtures schedules provided on the drawings.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture scheduled.

B. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components in the same category through one source from a single manufacturer.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"[; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act";] about plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for faucets:

1. Faucets: ASME A112.18.1M.
2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
3. Supply and Drain Fittings: ASME A112.18.1M.
4. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
5. Faucets: ASME A112.18.1M.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

G. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Floor Drains: ASME A112.21.1M.
2. Grab Bars: ASTM F 446.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Hot-Water Dispensers: ASSE 1023 and UL 499.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Supply, Flow-Control Fittings: Equal to 5 percent of amount of each type and size installed.
2. Flushometer Valve, Repair Kits: Equal to 5 percent of amount of each type installed, but not less than 10 of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in other Part 2 articles.

B. Provide plumbing fixtures in accordance with the plumbing fixture schedule included with the contract drawings. Provide all accessories (carriers, mounting hardware, seats, etc) as required to install and operate plumbing fixtures even if not specifically shown on the drawings or required by the specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install counter-mounting fixtures in and attached to casework.

C. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.

E. Install trap and tubular waste piping on drain outlet of each fixture an connect to drainage system.

F. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

G. Install toilet seats on water closets.

H. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

I. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.

J. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Plumbing Specification Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.
3. Clean fixtures to a reasonable degree of shine. No visable grease or other marks from construction should be apparent.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is

not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 224000

SECTION 230500 - COMMON WORK REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

D. Sheet metal construction documents are diagrammatic. Equivalent sizes can be substituted when construction begins as long as aspect ratios are no greater then 3:1 for rectangular, or round instead of square substitutions provide the same static pressure per 100ft. Duct runs are to be coordinated in the field with the other trades. Duct materials can not be changed without the permission of the engineer. Flex ducts are to be no longer than eight feet and must be supported from overhead.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve.

Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Sections.

3.7 PAINTING AND FINISHING

A. Apply semi-gloss, acrylic-enamel finish to exposed piping according to the following:

1. Interior, Ferrous Piping and Ferrous Supports: Finish coat over enamel undercoat and primer.
2. Interior and Exterior, Galvanized-Steel Piping: Two finish coats over galvanized metal primer.

3. Exterior, Ferrous Piping and Ferrous Supports: Two finish coats over rust-inhibitive metal primer.
4. Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved. Repair cut surfaces to match adjacent surfaces.

3.9 CONTROLS COORDINATION

A. For electrical interface of controls the following is the method to be coordinated with division 23. Division 23 is to provide junction box with cover, conduit, and power to JB. The cover is to be labeled with its respective panel number and breaker number. Control contractor will provide the control transformers and all wiring there after to devices and is to coordinate with Division 16 in the field.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.12 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230513

SECTION 230519 - METERS AND GAGES FOR HVAC 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. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.
11. Orifice flowmeters.
12. Pitot-tube flowmeters.
13. Turbine flowmeters.
14. Venturi flowmeters.
15. Vortex-shedding flowmeters.

B. Related Sections:

1. Division 23 Section "Facility Natural-Gas Piping" for gas meters.
2. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.

1.3 SUBMITTALS

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

B. Wiring Diagrams: For power, signal, and control wiring.

C. Product Certificates: For each type of meter and gage, from manufacturer.

D. 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, provide products by one of the following manufacturers:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

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 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Palmer Wahl Instrumentation Group.
    e. REOTEMP Instrument Corporation.
    f. Trerice, H. O. Co.
    g. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, [adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

B. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Marsh Bellofram.
    d. Miljoco Corporation.
    e. Palmer Wahl Instrumentation Group.
    f. REOTEMP Instrument Corporation.
    g. Trerice, H. O. Co.

h. Weiss Instruments, Inc.
i. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with [back] [front] flange and holes for panel mounting.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass].
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, back or bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Trerice, H. O. Co.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. 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, provide products by one of the following manufacturers:

    a. Flo Fab Inc.
    b. Miljoco Corporation.
    c. Palmer Wahl Instrumentation Group.
    d. Tel-Tru Manufacturing Company.
    e. Trerice, H. O. Co.
    f. Weiss Instruments, Inc.
    g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle, Back angle or Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. 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.

2.4 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.5 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 or 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.

2.6 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers.

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab Inc.
    e. Marsh Bellofram.
    f. Miljoco Corporation.
    g. Noshok.
    h. Palmer Wahl Instrumentation Group.
    i. REOTEMP Instrument Corporation.
    j. Tel-Tru Manufacturing Company.
    k. Trerice, H. O. Co.
    l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    m. Weiss Instruments, Inc.
    n. WIKA Instrument Corporation - USA.
    o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, 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.
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 manufacturers:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab Inc.
    e. Marsh Bellofram.
    f. Miljoco Corporation.
    g. Noshok.
    h. Palmer Wahl Instrumentation Group.
    i. REOTEMP Instrument Corporation.
    j. Tel-Tru Manufacturing Company.
    k. Trerice, H. O. Co.
    l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    m. Weiss Instruments, Inc.
    n. WIKA Instrument Corporation - USA.
    o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, 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.

2.7 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass stainless-steel pipe with NPS 1/4 pipe threads.

C. Valves: Brass ballwith NPS 1/4, ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), 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.

C. 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.

D. 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.

E. 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.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Archon Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Brooks Instrument.
4. Ernst Co., John C., Inc.
5. Ernst Flow Industries.
6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
7. OPW Engineered Systems; a Dover company.
8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

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.

2.11 FLOWMETERS

A. Orifice Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:

a. ABB; Instrumentation and Analytical.
b. Bell & Gossett; ITT Industries.
c. Meriam Process Technologies.
d. Preso Meters; a division of Racine Federated Inc.

e. S. A. Armstrong Limited; Armstrong Pumps Inc.

2. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.

    a. Design: Differential-pressure-type measurement for water.
    b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
    c. Minimum Pressure Rating: 300 psig.
    d. Minimum Temperature Rating: 250 deg F.

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.

    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.

    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Conversion Chart: Flow rate data compatible with sensor and indicator.
9. Operating Instructions: Include complete instructions with each flowmeter.

B. Pitot-Tube Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

    a. ABB; Instrumentation and Analytical.
    b. Emerson Process Management; Rosemount.
    c. Meriam Process Technologies.
    d. Preso Meters; a division of Racine Federated Inc.
    e. TACO Incorporated.
    f. Veris Industries, Inc.

2. Description: Flowmeter with sensor and indicator.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.

    a. Design: Differential-pressure-type measurement for water.
    b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
    c. Minimum Pressure Rating: 150 psig.
    d. Minimum Temperature Rating: 250 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Integral Transformer: For low-voltage power connection.
7. Accuracy: Plus or minus 3 percent.
8. Display: Shows rate of flow, with register to indicate total volume in gallons.
9. Operating Instructions: Include complete instructions with each flowmeter.

C. Turbine Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

    a. ABB; Instrumentation and Analytical.
    b. Data Industrial Corp.
    c. EMCO Flow Systems; a division of Spirax Sarco, Inc.
    d. ERDCO Engineering Corp.
    e. Hoffer Flow Controls, Inc.
    f. Liquid Controls; a unit of IDEX Corporation.
    g. McCrometer, Inc.
    h. Midwest Instruments & Controls Corp.
    i. ONICON Incorporated.
    j. SeaMetrics, Inc.
    k. Sponsler, Inc.; a unit of IDEX Corporation.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute.

    a. Design: Device or pipe fitting with inline turbine and integral direct-reading scale for water.
    b. Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
    c. Minimum Pressure Rating: 150 psig.
    d. Minimum Temperature Rating: 180 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 1-1/2 percent.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Operating Instructions: Include complete instructions with each flowmeter.

D. Venturi Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

    a. ABB; Instrumentation and Analytical.
    b. Gerand Engineering Co.
    c. Hyspan Precision Products, Inc.
    d. Preso Meters; a division of Racine Federated Inc.
    e. S. A. Armstrong Limited; Armstrong Pumps Inc.
    f. Victaulic Company.

2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.

    a. Design: Differential-pressure-type measurement for water.
    b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
    c. Minimum Pressure Rating: 250 psig.
    d. Minimum Temperature Rating: 250 deg F.
    e. End Connections for NPS 2 and Smaller: Threaded.
    f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
    g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.

    a. Scale: Gallons per minute.

b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Conversion Chart: Flow rate data compatible with sensor.
9. Operating Instructions: Include complete instructions with each flowmeter.

E. Vortex-Shedding Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. ABB; Instrumentation and Analytical.
b. Eastech Flow Controls.
c. EMCO Flow Systems; a division of Spirax Sarco, Inc.
d. Emerson Process Management; Rosemount.
e. Endress+Hauser.
f. ISTEC Corporation.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Inline type; for installing between pipe flanges and measuring flow directly in gallons per minute.

a. Design: Flow obstruction device, vortex-measurement type for liquids.
b. Construction: Stainless-steel body, with integral transmitter and direct-reading scale.
c. Minimum Pressure Rating: 1000 psig.
d. Minimum Temperature Rating: 500 deg F.
e. Integral Transformer: For low-voltage power operation.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 0.25 percent for liquids and 0.75 percent for gases.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install flow indicators in piping systems in accessible positions for easy viewing.

N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

O. Install flowmeter elements in accessible positions in piping systems.

P. Install wafer-orifice flowmeter elements between pipe flanges.

Q. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

R. Install permanent indicators on walls or brackets in accessible and readable positions.

S. Install connection fittings in accessible locations for attachment to portable indicators.

T. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

U. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.

3. Two inlets and two outlets of each chiller.
4. Inlet and outlet of each hydronic coil in air-handling units.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Inlet and outlet of each thermal-storage tank.
7. Outside-, return-, supply-, and mixed-air ducts.

V. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
3. Suction and discharge of each pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be[one of] the following:

1. [Liquid-filled] [Sealed], bimetallic-actuated type.
2. [Direct] [Remote]-mounted, [metal] [plastic]-case, vapor-actuated type.
3. [Compact] [Industrial]-style, liquid-in-glass type.
4. [Direct] [Remote]-mounted, light-activated type.
5. Test plug with [chlorosulfonated polyethylene synthetic] [EPDM] self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each hydronic boiler shall be the following:

1. Liquid-filled, bimetallic-actuated type.

C. Thermometers at inlets and outlets of each chiller shall be[one of] the following:

1. Liquid-filled, bimetallic-actuated type.

D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:

1. Liquid-filled, bimetallic-actuated type.

E. Thermometers at inlets and outlets of each hydronic heat exchanger shall be the following:

1. Liquid-filled, bimetallic-actuated type.

F. Thermometers at inlet and outlet of each thermal-storage tank shall be the following:

1. Liquid-filled, bimetallic-actuated type.

G. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be[one of] the following:

1. Sealed, bimetallic-actuated type.

H. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

B. Scale Range for Condenser-Water Piping: 0 to 150 deg F.

C. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

D. Scale Range for Air Ducts: [Minus 40 to plus 110 deg F] [Minus 40 to plus 110 deg F and minus 40 to plus 45 deg C].

E. Scale Range for Air Ducts: 0 to 100 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each pressure-reducing valve shall be[one of] the following:

1. Liquid-filled or Sealed direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be one of the following:

1. Liquid-filled direct mounted, metal case.

C. Pressure gages at suction and discharge of each pump shall be[one of] the following:

1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Condenser-Water Piping: 0 to 100 psi.

C. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Chilled-Water Piping: Venturi, rtex-shedding type.

B. Flowmeters for Condenser-Water Piping: Venturi, rtex-shedding type.

C. Flowmeters for Heating, Hot-Water Piping: Venturi, rtex-shedding type.

PART 4 - 4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230519

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Sections:
1. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

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: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of 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 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Metallic Coating: Electroplated zinc.
8. Paint Coating: Epoxy.
9. Plastic Coating: Epoxy.

2.5 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    1. Allied Tube & Conduit.
    2. Champion Fiberglass, Inc.
    3. Cooper B-Line, Inc.
    4. SEASAFE, INC.; a Gibraltar Industries Company.

B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

    1. Channels: Continuous slotted fiberglass channel with inturned lips.
    2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
    3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    1. Carpenter & Paterson, Inc.

2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-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.

2.7 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.

2.8 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.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 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. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. 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.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. 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.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. 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.

N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Insulated Piping:

1. Attach clamps and spacers to piping.

    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 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. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel 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. Use copper-plated pipe hangers and copper stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F,pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. 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.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
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.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. 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.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS 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 1 specification sections, apply to this section.

1.2 SUMMARY

A. Provide seismic restraints and supports for all mechanical equipment, piping, plumbing, and fire protection in accordance with the International Building Code, NFPA-13, SMACNA and standard practice.

B. Provide vibration isolators on all piping, ductwork, and equipment.

1.3 SUBMITTALS:

A. Product Data: Include load deflection curves for each vibration isolation device.

B. Shop Drawings: Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and for vibration isolation bases. All calculations shall be signed and sealed by a professional Engineer licensed in the state of New Jersey.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

A. Manufacturers:
1. Mason Industries, Inc.
2. Amber/Booth Company, Inc.
3. Kinetics Noise Control, Inc.

B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

C. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.

D. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

E. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers:

1. Amber/Booth Company, Inc.
2. California Dynamics Corp.

3. Isolation Technology, Inc.
4. Kinetics Noise Control, Inc.
5. Mason Industries, Inc.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation Co., Inc.
8. Vibration Mountings & Controls/Korfund.

B. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

B. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 EQUIPMENT BASES

A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.

B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. Isolator deflection.

3.5 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

D. Adjust active height of spring isolators.

3.6 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230548

SECTION 230553 – 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. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. 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.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in 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. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White

C. Background Color: Red

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT 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: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. 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. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: 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. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting".

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

    a. Background Color: Black.
    b. Letter Color: Yellow.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue For cold-air supply ducts.
2. Yellow For hot-air supply ducts.
3. Green For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

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 HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Chilled Water: 2 inches, round.
    b. Condenser Water: 2 inches, round.
    c. Refrigerant: 2 inches, round.
    d. Hot Water: 2 inches, round.
    e. Gas: 2 inches, round.

2. Valve-Tag Color:

    a. Chilled Water: Blue.
    b. Condenser Water: Yellow.
    c. Refrigerant: Black.
    d. Hot Water: Red.
    e. Gas: Yellow.

3. Letter Color:

    a. Chilled Water: White.
    b. Condenser Water: Black.
    c. Refrigerant: White.
    d. Hot Water: White.
    e. Gas: Black.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

C. Sample report forms.

D. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.

5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.

B. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer

C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the following:

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

a. Indicated versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.

j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches , and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm .
b. Total system static pressure in inches wg .
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg .
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm
b. Average face velocity in fpm

c. Air pressure drop in inches wg
d. Outdoor-air, wet- and dry-bulb temperatures in deg F
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.

k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.

e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.

d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.

e. Dates of calibration.

3.11 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure water flow of at least 5 percent of terminals.
    c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    d. Verify that balancing devices are marked with final balance position.
    e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Calcium silicate.
b. Cellular glass.
c. Flexible elastomeric.
d. Mineral fiber.
e. Phenolic.
f. Polyisocyanurate.
g. Polyolefin.
h. Polystyrene.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 22 Section "Plumbing Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.

4. Division 33 Section "Underground Hydronic Energy Distribution" for loose-fill pipe insulation in underground piping outside the building.
5. Division 33 Section "Underground Steam and Condensate Distribution Piping" for loose-fill pipe insulation in underground piping outside the building.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Sample Sizes:

a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
b. Sheet Form Insulation Materials: 12 inches square.
c. Jacket Materials for Pipe: 12 inches long by NPS 2.
d. Sheet Jacket Materials: 12 inches square.
e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

    a. One 10-foot section of NPS 2 straight pipe.
    b. One each of a 90-degree threaded, welded, and flanged elbow.
    c. One each of a threaded, welded, and flanged tee fitting.
    d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
    e. Four support hangers including hanger shield and insert.
    f. One threaded strainer and one flanged strainer with removable portion of insulation.
    g. One threaded reducer and one welded reducer.
    h. One pressure temperature tap.
    i. One mechanical coupling.

2. Ductwork Mockups:

    a. One 10-foot section each of rectangular and round straight duct.
    b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
    c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
    d. One rectangular and round transition fitting.
    e. Four support hangers for round and rectangular ductwork.

3. Equipment Mockups:

a. One chilled-water pump and one heating-hot-water pump.
b. One tank or vessel.

4. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
5. Notify Engineer seven days in advance of dates and times when mockups will be constructed.
6. Obtain Engineer's approval of mockups before starting insulation application.
7. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
8. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
9. Demolish and remove mockups when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cell-U-Foam Corporation; Ultra-CUF.
    b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. Rubatex Corp.
    d. Armstrong World Industries, Inc.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II without facing and with all service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil and vinyl film

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB. without facing and with all service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil and vinyl film

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000 Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with all purpose factory applied vapor-retarder jacket.

3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with all purpose factory applied vapor-retarder jacket.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to

ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Insulco, Division of MFS, Inc.; Triple I.
    b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Insulco, Division of MFS, Inc.; SmoothKote.
    b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.

c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-35.
    b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    c. ITW TACC, Division of Illinois Tool Works; CB-50.
    d. Marathon Industries, Inc.; 590.
    e. Mon-Eco Industries, Inc.; 55-40.
    f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F .
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-30.
    b. Foster Products Corporation, H. B. Fuller Company; 30-35.
    c. ITW TACC, Division of Illinois Tool Works; CB-25.
    d. Marathon Industries, Inc.; 501.
    e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F .
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; Encacel.
    b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
    c. Marathon Industries, Inc.; 570.
    d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F .
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-52.
    b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    c. Marathon Industries, Inc.; 130.
    d. Mon-Eco Industries, Inc.; 11-30.
    e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76-8.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.

e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; Chil-Glas No. 5.

b. Vimasco Corporation; Elastafab 894.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; Chil-Glas No. 5.
b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White
4. Factory-fabricated fitting covers to match jacket.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Factory cut and rolled to size.
    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 2-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.

D. 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. Products: Subject to compliance with requirements, provide one of the following:

    a. Pittsburgh Corning Corporation; Pittwrap.
    b. Polyguard; Insulrap No Torch 125.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    b. Compac Corp.; 104 and 105.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils .
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches .
3. Thickness: 6.5 mils .
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    b. Compac Corp.; 130.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    d. Venture Tape; 1506 CW NS.

2. Width: 2 inches .
3. Thickness: 6 mils .

4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209 , Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

2. Products: Subject to compliance with requirements, provide one of the following:

   1) AGM Industries, Inc.; CWP-1.
   2) GEMCO; CD.
   3) Midwest Fasteners, Inc.; CD.

4) Nelson Stud Welding; TPA, TPC, and TPS.

3. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. C & F Wire.
   b. Childers Products.
   c. PABCO Metals Corporation.
   d. RPR Products, Inc.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch , aluminum according to ASTM B 209 , Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch , stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Provide an additional one hundred-fifty feet of preformed insulation and one hundred-fifty square feet of blanket and board type insulation as well as accessories and labor for each size, thickness and type used on the project to accommodate any changes required to resolve interferences or as directed by the Engineer.

I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

J. Install insulation with least number of joints practical.

K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor

insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at 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. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches .
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches .
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum, at least 0.060 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to

and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or

union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch , and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch , and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch 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; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

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 (300 mm) o.c. and at end joints.

3.11 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.12 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

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.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to ten location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
2. Inspect field-insulated equipment, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to ten location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to ten locations of straight pipe, ten locations of threaded fittings, ten locations of welded fittings, five locations of threaded strainers, five locations of welded strainers, ten locations of threaded valves, and ten locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Factory-insulated plenums and casings.
2. Flexible connectors.
3. Vibration-control devices.
4. Factory-insulated access panels and doors.

3.15 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

E. Concealed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

F. Concealed, rectangular, return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

G. Concealed, rectangular, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

J. Concealed, supply-air plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

K. Concealed, return-air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

L. Concealed, outdoor-air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

M. Concealed, exhaust-air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

N. Exposed, round and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

O. Exposed, round and flat-oval, return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

P. Exposed, round and flat-oval, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

Q. Exposed, round and flat-oval, exhaust-air duct insulation shall be the following:

R.
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

S. Exposed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

T. Exposed, rectangular, return-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

U. Exposed, rectangular, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

V. Exposed, rectangular, exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

W. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated board, thickness as required to achieve 2-hour fire rating.

X. Exposed, supply-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

Y. Exposed, return-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

Z. Exposed, outdoor-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

AA. Exposed, exhaust-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

3.16 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

D. Concealed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

E. Concealed, rectangular, return-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

F. Concealed, supply-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

G. Concealed, return-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

H. Exposed, round and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

I. Exposed, round and flat-oval, return-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

J. Exposed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

K. Exposed, rectangular, return-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

L. Exposed, supply-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

M. Exposed, return-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

3.17 EQUIPMENT INSULATION SCHEDULE

A. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

B. Chillers: Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, condenser bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with the following:
1. Flexible Elastomeric: 1 inch thick.

C. Chilled-water pump insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

D. Condenser-water pump insulation shall bethe following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

E. Dual-service heating and cooling pump insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

F. Heating-hot-water pump insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

G. Heat-recovery pump insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick 3-lb/cu. ft. nominal density.

H. Chilled-water expansion/compression tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

I. Condenser-water expansion/compression tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

J. Dual-service heating and cooling expansion/compression tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

K. Heating-hot-water expansion/compression tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

L. Heat-recovery expansion/compression tank insulation shall be the following:
1. Mineral-Fiber Pipe and Tank: 2 inches thick.

M. Chilled-water air-separator insulation shall be the following:
1. Mineral-Fiber Pipe and Tank: 2 inches thick.

N. Condenser-water air-separator insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

O. Dual-service heating and cooling air-separator insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

P. Heating-hot-water air-separator insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

Q. Heat-recovery air-separator insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

R. Piping system filter-housing insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

S. Outdoor, aboveground, heated, fuel-oil storage tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

3.18 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.

3.19 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F :

1. All Pipe Sizes: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Chilled Water and Brine:

1. NPS 3 and Smaller: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

2. NPS 4 to NPS 12 : Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inches

3. NPS 14 and Larger: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 3 inches

C. Condenser-Water Supply and Return:

1. NPS 3 and Smaller: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

2. NPS 4 to NPS 12 : Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inches

3. NPS 14 and Larger: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 3 inches

D. Heating-Hot-Water Supply and Return:

1. NPS 3 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

2. NPS 4 to NPS 12 : Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inches

3. NPS 14 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 3 inches

E. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1-1/2 inches thick.

F. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1-1/2 inches thick.

3.20 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine:

1. NPS 3 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

2. NPS 4 to NPS 12 : Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inches

3. NPS 14 and Larger: Insulation shall be the following:

B. Condenser-Water Supply and Return:

1. NPS 3 and Smaller: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

2. NPS 4 to NPS 12 : Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inches

3. NPS 14 and Larger: Insulation shall be the following:

C. Heating-Hot-Water Supply and Return:

1. NPS 3 and Smaller: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

2. NPS 4 to NPS 12 : Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe, Type I: 2-1/2 inches

3. NPS 14 and Larger: Insulation shall be the following:

D. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:

    a. Flexible Elastomeric: 2 inches thick.

E. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

    a. Flexible Elastomeric: 2 inches thick.

F. Fuel Oil Piping, Heated:

1. All Pipe Sizes: Insulation shall be the following:

    a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.21 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Chilled Water, All Sizes: Cellular glass, 3 inches thick.

B. Condenser-Water Supply and Return, All Sizes: Cellular glass, 3 inches thick.

C. Heating-Hot-Water Supply and Return, All Sizes,: Cellular glass, 3 inches thick.

D. Fuel Oil Piping, All Sizes, Heated: Cellular glass, 3 inches thick.

3.22 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. Ducts and Plenums, Concealed:

1. Paper and Foil with Vapor Retarder

D. Ducts and Plenums, Exposed:

1. Painted Aluminum, Smooth: 0.032 inches thick.

E. Equipment, Concealed:

1. Paper and Foil with Vapor Retarder

F. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches :

1. PVC 30 mils thick.

G. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches :

1. Painted Aluminum, Smooth 0.032 inch thick.

H. Piping, Concealed:

1. Paper and Foil with Vapor Retarder

I. Piping, Exposed:

1. PVC 30 mils thick.

3.23 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Aluminum, Smooth 0.040 inch thick.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Smooth 0.040 inch thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches :

1. Aluminum, Smooth 0.040 inch thick.

F. Equipment, Concealed:

1. Aluminum, Smooth 0.040 inch thick.

G. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches :

1. Aluminum, Smooth 0.040 inch thick.

H. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches :

1. Aluminum, Smooth 0.040 inch thick.

I. Piping, Concealed:

1. Aluminum, Smooth 0.040 inch thick.

J. Piping, Exposed:

1. Aluminum, Smooth 0.040 inch thick.

3.24 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material. 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.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 230700

SECTION 231123 – FACILITY NATURAL-GAS 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. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 65 psig .

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars
6. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot .
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

E. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

F. Qualification Data: For qualified professional engineer.

G. Welding certificates.

H. Field quality-control reports.

I. Operation and Maintenance Data: For motorized gas valves, pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect, Construction Manager, Owner and Engineer no fewer than ten days in advance of proposed interruption of natural-gas service.

2. Do not proceed with interruption of natural-gas service without Construction Manager's and Owner's written permission.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Dresser Piping Specialties; Division of Dresser, Inc.

2) Smith-Blair, Inc.

b. Stainless-steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Stainless-steel bolts, washers, and nuts.
e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. OmegaFlex, Inc.
b. Parker Hannifin Corporation; Parflex Division.
c. Titeflex.
d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.

5. Operating-Pressure Rating: 0.5 psig .
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches .

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60 mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig .

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig .
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BrassCraft Manufacturing Company; a Masco company.

b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.
f. .

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McDonald, A. Y. Mfg. Co.
b. Mueller Co.; Gas Products Div.
c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flowserve.
    b. Homestead Valve; a division of Olson Technologies, Inc.
    c. McDonald, A. Y. Mfg. Co.
    d. Milliken Valve Company.
    e. Mueller Co.; Gas Products Div.
    f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

J. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Kerotest Manufacturing Corp.
    b. Lyall, R. W. & Company, Inc.
    c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig
8. Operating Temperature: Minus 20 to plus 140 deg F
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

K. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASCO Power Technologies, LP; Division of Emerson.
b. Dungs, Karl, Inc.
c. Eaton Corporation; Controls Div.
d. Eclipse Combustion, Inc.
e. Honeywell International Inc.
f. Johnson Controls.

2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASCO Power Technologies, LP; Division of Emerson.
b. Dungs, Karl, Inc.
c. Eclipse Combustion, Inc.
d. Goyen Valve Corp.; Tyco Environmental Systems.
e. Magnatrol Valve Corporation.
f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig .
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

B. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pacific Seismic Products, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 7 psig

4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    d. Invensys.
    e. Richards Industries; Jordan Valve Div.
    .

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

12. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Actaris.
      b. American Meter Company.
      c. Eclipse Combustion, Inc.
      d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
      e. Invensys.
      f. Maxitrol Company.
      g. Richards Industries; Jordan Valve Div.

   2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
   3. Springs: Zinc-plated steel; interchangeable.
   4. Diaphragm Plate: Zinc-plated steel.
   5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
   6. Orifice: Aluminum; interchangeable.
   7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
   8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
   9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
   10. Overpressure Protection Device: Factory mounted on pressure regulator.
   11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
   12. Maximum Inlet Pressure: 5 psig (34.5 kPa).

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Canadian Meter Company Inc.
      b. Eaton Corporation; Controls Div.
      c. Harper Wyman Co.
      d. Maxitrol Company.
      e. SCP, Inc.

   2. Body and Diaphragm Case: Die-cast aluminum.
   3. Springs: Zinc-plated steel; interchangeable.
   4. Diaphragm Plate: Zinc-plated steel.
   5. Seat Disc: Nitrile rubber.

6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig

2.8 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with ANSI B109.1 and ANSI B109.2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Invensys.

2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet and liters.
8. Meter Case and Index: Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Pressure Loss: Maximum 0.5-inch wg.
12. Accuracy: Maximum plus or minus 1.0 percent.

B. Rotary-Type Service Meters: Comply with ANSI B109.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Meter Company.
    b. Invensys.

2. Case: Extruded aluminum.
3. Connection: Flange.
4. Impellers: Polished aluminum.
5. Rotor Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet and liters.
8. Tamper resistant.

9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig .
11. Accuracy: Maximum plus or minus 2.0 percent.

C. Turbine Meters: Comply with ASME MFC-4M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Meter Company.
    b. Invensys.

2. Housing: Cast iron or welded steel.
3. Connection Threads or Flanges: Steel.
4. Turbine: Aluminum or plastic.
5. Turbine Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet and liters.
8. Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig .
11. Accuracy: Maximum plus or minus 2.0 percent.

D. Service-Meter Bars:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Mueller Co.; Gas Products Div.
    f. Perfection Corporation; a subsidiary of American Meter Company.

2. Malleable- or cast-iron frame for supporting service meter.
3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

E. Service-Meter Bypass Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lyall, R. W. & Company, Inc.
b. Williamson, T. D., Inc.

2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
3. Integral ball-check bypass valve.

2.9 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig .
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
d. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig .
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.10 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Provide an additional thirty feet of gas piping and accessories and installation labor for each size of pipe used on the project to accommodate any changes required to resolve interferences or as directed by the engineer.

N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

Q. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

S. Connect branch piping from top or side of horizontal piping.

T. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

U. Do not use natural-gas piping as grounding electrode.

V. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

W. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

X. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground, on concrete bases.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Division 05 Section "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.

4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.8 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches ; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

CONNECTIONS

D. Connect to utility's gas main according to utility's procedures and requirements.

E. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

F. Install piping adjacent to appliances to allow service and maintenance of appliances.

G. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

H. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel gloss.
d. Color: Yellow.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex gloss.
d. Color: Yellow.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

C. Underground, below building, piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

A. Aboveground Piping: Maximum operating pressure more than 5 psig.

B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.

C. Aboveground, distribution piping shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

D. Underground, below building, piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. NPS 2-1/2 and Larger: Cast-iron, lubricated plug valves.

3.18 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

E. Valves in branch piping for single appliance shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 231123

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Division 23 Section “Duct Insulation” for insulation for metal ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7, SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems.

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

E. Welding certificates.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

E. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

F. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. McGill AirFlow LLC.
2. Sheet Metal Connectors, Inc.

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

G. Inner Duct: Minimum 0.028-inch solid steel galvanized sheet steel.

H. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Traverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

I. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.

d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Fabricate round ducts larger than 90 inch in diameter with butt-welded longitudinal seams.
    b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Inner Duct: Minimum 0.028-inch solid galvanized sheet steel.

D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

I. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 SEISMIC-RESTRAINT DEVICES

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. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Provide an extra 100 lbs of ductwork to accommodate ductwork revisions required to resolve interferences or as directed by the Engineer.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

K. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items

during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint exterior of exposed ductwork with color as selected by the architect. Paint interior of metal ducts that are visible through registers and grilles. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
    b. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

c. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
d. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. All exposed round ductwork as shown on the contract drawings shall be double wall insulated spiral type. Coordinate finish color with Architect.

C. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 3-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

D. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg .
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

E. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 3.

F. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

G. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:

    a. Exposed to Airstream: Match duct material.
    b. Not Exposed to Airstream: Galvanized.

3. Stainless-Steel Ducts:

    a. Exposed to Airstream: Match duct material.
    b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum.

H. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 1 inch thick.
2. Return Air Ducts: 1 inch thick.
3. Exhaust Air Ducts: 1 inch thick.

I. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Velocity 1000 fpm or Lower:

        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
        2) Mitered Type RE 4 without vanes.

    b. Velocity 1000 to 1500 fpm:

        1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
        3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

    c. Velocity 1500 fpm or Higher:

        1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
        3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

J. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Flexible ducts.
17. Duct security bars.
18. Duct accessory hardware.

B. Related Sections:

1. Division 23 Section "HVAC Power Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and a polished finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2200 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.052-inch- thick, galvanized sheet steel with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Plated steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.

    a. Sleeve Thickness: 20-gage minimum.
    b. Sleeve Length: 6 inches minimum.

6. Screen Material: Galvanized steel or Aluminum.
7. Screen Type: Insect.
8. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2200 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.064-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades:

1. Multiple, 0.025-inch- thick, roll-formed aluminum.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

G. Blade Seals: Neoprene.

H. Blade Axles: Galvanized steel.

I. Tie Bars and Brackets:

1. Material: Galvanized steel.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic or Stainless steel.

L. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

    a. Air Balance Inc.; a division of Mestek, Inc.
    b. American Warming and Ventilating; a division of Mestek, Inc.
    c. Flexmaster U.S.A., Inc.
    d. McGill AirFlow LLC.
    e. METALAIRE, Inc.
    f. Nailor Industries Inc.
    g. Pottorff; a division of PCI Industries, Inc.
    h. Ruskin Company.
    i. Trox USA Inc.
    j. Vent Products Company, Inc.

2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Hat, U, Angle shaped.
    b. Galvanized-steel channels, 0.064 inch thick.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized, roll-formed steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze, Molded synthetic, Stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Blade Seals: Vinyl or Neoprene.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

B. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Pottorff; a division of PCI Industries, Inc.
h. Ruskin Company.
i. Trox USA Inc.
j. Vent Products Company, Inc.

2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat, U, Angle-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
d. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

6. Blade Axles: Stainless steel.
7. Bearings:

a. Oil-impregnated bronze, Molded synthetic, Stainless-steel sleeve.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Blade Seals: Vinyl or Neoprene.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Aluminum.
11. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. Lloyd Industries, Inc.
8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
9. McGill AirFlow LLC.
10. METALAIRE, Inc.
11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat, U, Angle] shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Parallel- and opposed-blade design.
3. Galvanized steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.

E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze, Molded synthetic or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company.
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Fire Rating: 1-1/2 and 3 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. PHL, Inc.
6. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

F. Leakage: Class I .

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

I. Damper Motors: Modulating or two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Momentary test switch, remote mounted.

2.8 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.9 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative type with fill material.

a. Fill Material: Moisture-proof nonfibrous material.
b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Flange connections.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Accessories:

1. Factory-installed end caps to prevent contamination during shipping.
2. Removable splitters.
3. Airflow measuring devices.

L. Source Quality Control: Test according to ASTM E 477.

1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.10 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E.

F. Vane Construction: Single wall for ducts up to 8 inches wide and double wall for larger dimensions.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches[with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.14 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.15 DUCT SECURITY BARS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Carnes.
2. KEES, Inc.
3. Lloyd Industries, Inc.

4. Metal Form Manufacturing, Inc.
5. Price Industries.

B. Description: Field- or factory-fabricated and field-installed duct security bars.

C. Configuration:

1. Frame: 10 gage by 2 inches.
2. Sleeve: 3/16-inch, continuously welded steel frames with 1-by-1-by-3/16-inch angle frame factory welded to 1 end and furnished loose for field welding on other end. To be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.
3. Horizontal Bars: 1/2 inch.
4. Vertical Bars: 3/4 inch.
5. Bar Spacing: 6 inches.
6. Mounting: Ductwork or other framing.

2.16 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

I. Connect ducts to duct silencers rigidly.

J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

K. Install access doors with swing against duct static pressure.

L. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

N. Install flexible connectors to connect ducts to equipment.

O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. Connect terminal units to supply ducts directly.

Q. Connect diffusers or light troffer boots to ducts directly or with maximum 10’-0” lengths of flexible duct clamped or strapped in place.

R. Connect flexible ducts to metal ducts with stainless steel clamps.

S. Install duct test holes where required for testing and balancing purposes.

T. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Centrifugal roof ventilators.
   2. Ceiling-mounting ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Wiring Diagrams: Power, signal, and control wiring.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: two set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Centrifugal Roof Ventilators:

a. Greenheck Fan Corp
b. Cook, Loren Company (Basis of Design).
c. Penn Ventilation Companies, Inc.

2. Ceiling-Mounting Ventilators:

a. Greenheck Fan Corp
b. Cook, Loren Company (Basis of Design).
c. Penn Ventilation Companies, Inc.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven and direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories as scheduled on the contract drawings.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
4. Variable-Speed Controller for Direct Drive Fans: Solid-state control to reduce speed from 100 percent to less than 50 percent.
5. Additional accessories as noted on the exhaust fan equipment schedules.

F. Roof Curbs: Roof curb shall be Trapezoidal fixed cell standing seam roof sloped seismic roof curb by Thybar or approved equal. Coordinate final roof type with Architect and Structural contractor.

1. Overall Height: 18 inches.
2. Sound Curb: Curb with sound-absorbing insulation matrix.
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.
5. Hinged Subbase: Galvanized steel hinged arrangement permitting service and maintenance.
6. Mounting Pedestal: Galvanized steel with removable access panel.

2.3 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Painted Steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
2. Manufacturer's standard roof jack or wall cap, and transition fittings.
3. Isolation: Rubber-in-shear vibration isolators.
4. Additional accessories as noted on the exhaust fan equipment schedules.

2.4 MOTORS

A. Refer to Division 15 Section "Motors" for general requirements for factory-installed motors.

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

C. Enclosure Type: TEFC.

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Provide one additional exhaust fan similar to EF-2 as scheduled on the drawings to be used as directed by the Engineer.

E. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections:
   1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
   2. Division 23 Section “Testing, Adjusting, and Balancing for HVAC” for balancing diffusers, registers and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Manufacturers:
1. Titus
2. Tuttle & Bailey
3. Price (Basis of Design)
4. Krueger

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve

design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Provide an additional five diffusers/registers of each type and size used on the project to accommodate ductwork revisions required to resolve interferences or as directed by the Engineer.

D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 233713

SECTION 235533 - FUEL-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gas -fired unit heaters.

1.2 SUBMITTALS

A. Product Data: For each type of fuel-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: four (4) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GAS-FIRED UNIT HEATERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements a comparable product by one of the following:

1. Lennox Industries, Inc.
2. Modine Manufacturing Company.
3. Reznor/Thomas & Betts Corporation. (Basis of Design)
4. Sterling HVAC Products; Div. of Mestek Technology Inc.

D. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

E. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

F. Type of Venting: separated combustion, power vented.

G. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

H. Heat Exchanger: Stainless steel.

I. Unit Fan: Propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.

J. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Two stage.
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Flame rollout switch.
5. Control transformer.
6. High Limit: Thermal switch or fuse to stop burner.
7. Thermostats: Devices and wiring are specified in Division 23 Section "Instrumentation and Control for HVAC."
8. Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

9. Thermostat: 2-stage, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.
10. Thermostat: Single-stage type with duct-mounting sensor and 50 to 90 deg F (10 to 32 deg C) operating range.
11. Thermostat: 2-stage type with duct-mounting sensor and 50 to 90 deg F (10 to 32 deg C) operating range.

K. Discharge Louvers: Independently adjustable horizontal blades.

L. Accessories:

1. Vertical discharge louvers.
2. Discharge Nozzle: Discharge at 25 to 65 degrees from horizontal.
3. Four-point suspension kit.
4. Summer fan switch.
5. Unit-mounted thermostat bracket.
6. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
7. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

B. Install and connect oil-fired unit heaters and associated fuel and vent piping according to NFPA 31, applicable local codes and regulations, and manufacturer's written installation instructions.

C. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

D. Install piping adjacent to fuel-fired unit heater to allow service and maintenance.

E. Gas Piping: Comply with Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

F. Fuel Oil Piping: Comply Division 23 Section "Facility Fuel-Oil Piping." Connect to fuel oil supply and return piping with shutoff valve and union at each connection.

G. Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, and Stacks."

H. Electrical Connections: Comply with applicable requirements in Division 26 Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

I. Adjust initial temperature set points.

J. Adjust burner and other unit components for optimum heating performance and efficiency.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 235533

SECTION 238239 - 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. This Section includes propeller unit heaters.

1.3 SUBMITTALS

A. Product Data: Include specialties and accessories for each unit type and configuration.

B. Shop Drawings: Submit the following for each unit type and configuration:

1. Plans, elevations, sections, and details.
2. Details of anchorages and attachments to structure and to supported equipment.
3. Power, signal, and control wiring diagrams. Differentiate between manufacturer-installed and field-installed wiring.
4. Equipment schedules to include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

C. Field Test Reports: Written reports of tests specified in Part 3 of this Section.

D. Maintenance Data: For propeller unit heaters to include in maintenance manuals specified in Division 01. Include the following:

1. Maintenance schedules and repair parts lists for motors, coils, integral controls, and filters.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate layout and installation of propeller unit heaters and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Indeeco (Basis of Design).
2. Carrier Corp.
3. Markel.
4. Berko.
5. Modine.
6. Trane Company (The); North American Commercial Group.

2.2 UNIT HEATERS

A. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with horizontal, adjustable louvers in blow-through configuration. Electric heaters shall be UL Listed have built-in controls and shall be prewired.

B. Washdown / corrosion resistant unit heaters shall be UL and cUL Listed for corrosive areas and NEMA 4X hose down requirements.

2.3 MATERIALS

A. Casing: Heavy gauge steel protected from corrosion by either a galvanized coating or a durable baked on polyester powder coat finish, with removable panels.

B. Washdown / Corrosion Resistant Casing: Heavy gauge steel protected from corrosion by epoxy painted stainless steel parts housing, with removable panels. Heating elements and motor shall be enclosed in round, heavy 16 gauge stainless steel shroud with stainless steel louvered outlet grille and plated rear grille.

2.4 ELECTRIC-RESISTANCE HEATING ELEMENTS

A. Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium-oxide insulating refractory and sealed in high-mass steel sheath, epoxy sealed for moisture resistance with steel type fins copper brazed to steel sheath no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

B. Washdown / corrosion resistant heating elements shall be finned tubular heating elements of type 316 stainless steel sheath with mechanically wound stainless steel fins and mounting fittings.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for overtemperature protection of heaters.
2. Wiring Terminations: Match conductor materials and sizes indicated.

2.5 FAN

A. Propeller with aluminum blades directly connected to motor.

B. Washdown / Corrosion resistant unit heaters shall have epoxy coated aluminum fan blades.

2.6 FAN MOTORS

A. Motors shall be UL Recognized, permanently lubricated ball bearings and thermally protected.

B. Washdown / corrosion resistant unit heater motors shall be of the totally enclosed type designed to resist moisture and corrosion. The motor shall be factory wired to a NEMA 4X enclosure.

2.7 ACCESSORIES

A. Provide an outlet grille that shall have individually adjustable directional louvers, a cone diffuser or radial diffuser. Provide an outlet protective grille that shall prevent debris from reaching the element compartment. Provide an inlet grille that shall comply with OSHA requirements for a fan blade guard.

B. Provide single point line voltage connection for incoming power that enables heater, fan and controls to be connected to the same branch circuit.

C. Universal wall and ceiling brackets for mounting of the unit heaters.

2.8 CONTROLS

A. Control Devices: Unit-mounted thermostat. Provide the following built-in controls.

1. Automatic reset thermal cutout for primary over-temperature protection and a secondary manual reset cutout shall be provided on heaters 20 KW and above.
2. 24 VAC transformer and disconnecting magnetic contactor.
3. Fan delay to eliminate cold drafts when fan starts and dissipate stored element heat before fan shuts down.
4. Built-in power fusing for heater loads over 48 amps.

B. Washdown / corrosion resistant unit heaters shall have a NEMA 4X enclosure to house element terminals and the following built-in controls.

1. Automatic reset overtemperature cutout
2. 24V Control Transformer
3. Fan Delay Relay
4. Contactors
5. Terminal blocks for field wiring
6. Disconnect switch

2.9 SOURCE QUALITY CONTROL

A. Test propeller unit heater coils according to ASHRAE 33.

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.

B. Examine roughing-in for piping and electrical connections to verify actual locations before propeller unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters level and plumb.

B. Install propeller unit heaters to comply with NFPA 90A.

C. Suspend propeller unit heaters from structure with rubber-in-shear vibration isolators (rubber hangers). Vibration isolators are specified in Division 015 Section "Mechanical Vibration Controls and Seismic Restraints."

D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 015 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Unless otherwise indicated, install shutoff valve and union or flange on each connection.

C. Install piping adjacent to machine to allow service and maintenance.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing and report results in writing:

1. 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 safeties.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.5 CLEANING

A. After installing units, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. After installing units, clean propeller unit heaters internally according to manufacturer's written instructions.

C. Install new filters in each propeller unit heater within two weeks after Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."
3. Review data in maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 238239

SECTION 238419 - DESICCANT DEHUMIDIFICATION UNITS

PART 1 GENERAL

1.01 MANUFACTURER

A. Experience
The manufacturer of the dehumidifier shall have a minimum of ten years of documented field operating experience with the specific equipment proposed.

B. ISO 9001 - Manufacturing, sales, field service, and quality assurance
The manufacturer shall produce and service the proposed equipment in a consistent and high-quality manner and shall provide documentation of that fact. ISO-9001 certification is acceptable as documentation of a comprehensive quality assurance process. In the absence of ISO-9001 certification, the manufacturer shall provide current copies of all manufacturing and field service procedures along with independent audit verification that the procedures are consistently and currently enforced.

C. Critical Proprietary Components
Whenever possible, the manufacturer shall use components which are generally available from more than one manufacturer. If a proprietary component must used in the dehumidifier, the part shall be manufactured in at least two geographically-separated plants to eliminate the risk of a dehumidifier breakdown at a time when a unique manufacturing plant is incapacitated. The manufacturer shall provide certification that all components are either available from two manufacturers, or provide the locations of at least two separate manufacturing plants for any proprietary components.

D. Manufacturers: Subject to compliance with requirements, provide desiccant dehumidification units by one of the following:

1. Munters
2. Approved Equal

1.02 SUBMITTALS

A. Requirements for equipment approval
The manufacturer shall provide the documentation needed to verify that the equipment will perform as the schedule requires, and that it will accomplish the task with the utilities provided and in the space allowed. Towards that end, the manufacturer shall submit the following documents for approval prior to production.

1. Technical Data Sheet
The performance of the equipment at the specified conditions shall be described on a project-specific technical data sheet which includes:

a. Unit

1) Electrical utility
2) Full load amps
3) Project name and HVAC system designation defined by these specifications
4) End user name and installation location

b. Process air side
1) Process air flow
2) Inlet dry bulb temperature
3) Inlet humidity ratio
4) Outlet dry bulb temperature
5) Outlet humidity ratio
6) Pressure drop through the desiccant wheel
7) Pressure drop through the entire dehumidifier
8) External static pressure available (if applicable)
9) Motor horsepower
10) Fan rotation and discharge position

c. Reactivation air side
1) Reactivation air flow
2) Inlet dry bulb temperature
3) Inlet humidity ratio
4) Outlet dry bulb temperature
5) Outlet humidity ratio
6) Pressure drop through the desiccant wheel
7) Pressure drop through the entire dehumidifier
8) External static pressure available
9) Motor horsepower
10) Fan rotation and discharge position

d. Reactivation energy
1) Reactivation energy type
2) Net reactivation energy consumption rate at the specified conditions
3) Method of automatic energy modulation in response to moisture load changes
4) Inlet dry bulb temperature

2. Manufacturer's certifications
With the documents and drawings submitted for approval, the manufacturer shall provide written certifications to document compliance with the following requirements.

a. ISO-9001 registration number and the certificate which documents the quality assurance programs of manufacturing and field service
b. Description of any proprietary components, along with documentation of the two or more geographically-separated manufacturing plants required for each component.
c. Certification that the unit wiring complies with the current National Electrical code

d. Independent report of the flame spread test for the desiccant wheel, performed in accordance with ASTM E84-90 - *Standard test method for surface burning characteristics of building materials*.
e. Material supplier certification that the desiccant wheel contains no fibers with a diameter smaller than 5 microns.
f. The address and telephone number of the factory-certified service center nearest the installation location.
g. Telephone number for the 24-hour, 7-day technical support required by the specification.

3. Product drawings
The manufacturer shall provide drawings of the proposed equipment which show:

a. A minimum of four dimensioned views of the equipment
   1) Plan view
   2) Controller side elevation
   3) Process air inlet side elevation
   4) Process air outlet side elevation

b. Centerline locations and dimensions of all connection points
   1) Process air inlet
   2) Process air outlet
   3) Reactivation air inlet
   4) Reactivation air outlet

c. Clearances and service access areas required for:
   1) Desiccant wheel removal
   2) Desiccant wheel drive service
   3) Airflow adjustment

d. Casing material and the net unit weight as proposed including all unit-mounted and remote-mounted components required to meet these specifications.

4. Operating & Maintenance manual
The manufacturer shall provide a copy of the operating and maintenance manual for the proposed equipment. As a minimum, the manual shall contain:

a. Installation guidelines
b Start-up checklist
c. Troubleshooting guide
d. Sequence of operations
e. Internal wiring diagram showing interconnection points for power and controls
f. Electrical parts list
g. Required maintenance activities and their recommended frequency.
h. A list of recommended spare parts with the name, address and telephone number of the organization which supplies each part.
i. 24-hour, 7-day service assistance telephone number

1.04 PUBLISHED PERFORMANCE DATA

A. The manufacturer shall provide published performance data for all proposed equipment, so the approval authority can determine whether the unit has been selected within its normal operating range. Equipment for which there is no full range of published performance data shall not be acceptable. Equipment selected outside of the range of published performance data shall not be acceptable.

1.05 STANDARD WARRANTY

A. The manufacturer shall be notified in writing of the date the equipment is to be started up. The dehumidifier and any auxiliary components provided by the manufacturer shall be warranted free from defects in workmanship or material for a period of 13 months from the date the equipment is shipped from the manufacturer's plant, or for a period of 12 months from the date of documented start up, whichever comes sooner.

B. If any defects appear under this warranty, the manufacturer shall be notified by the owner, and the manufacturer shall provide appropriate replacement parts at no cost to the owner other than freight. The owner shall be responsible for labor performed in replacing parts provided by the manufacturer.

C. Honeycombe® Wheels

1. Structural integrity:

Cargocaire warrants its Honeycombe® Titanium-enhanced Silica Gel, Molecular Sieve, Lithium Chloride and HPX Honeycombe® wheels to be free from defects in workmanship and material for a period of five years commencing thirty (30) days from the date of shipment by Cargocaire. Lithium Chloride wheels require that the customer maintain a ServiceCaire Agreement on existing equipment that needs a replacement wheel, or a PrimaCaire or Extended PrimaCaire Agreement on new equipment.

2. Performance:

Cargocaire allows a pro-rated warranty on its Honeycombe® Titanium-enhanced Silica Gel, Molecular Sieve, Lithium Chloride and HPX Honeycombe® wheels to maintain their specified adsorption/absorption capacity as measured on the specified Technical Data Sheet for a period of five years commencing thirty (30) days from the date of shipment by Cargocaire. The terms of this warranty are conditional upon the customer maintaining a ServiceCaire Agreement on existing equipment that needs a replacement wheel, or a PrimaCaire or Extended PrimaCaire Agreement on new equipment. It is a condition of this performance warranty that one of these three Cargocaire service programs be in place (uninterrupted during these five years) on the piece of equipment housing the warranted wheel. The provision above apply to properly designed, applied and maintained equipment.

1.05 COMPREHENSIVE SERVICE PROGRAMS

A. The manufacturer shall provide factory start-up, extended warranty, and three (3) subsequent visits to the site during the first two years (twenty-four months from date of start-up or twenty-seven months from date of shipment, whichever is less) to inspect the equipment and monitor its performance. Extended warranty will consist of repair or replacement of defective parts and on-site labor. Travel and living expenses are not covered for warranty visits. The standard parts warranty shall be extended to twenty-four (24) months. Inspection shall consist of two (2) performance tests and inspection visits during the warranty period.

B. The manufacturer shall provide for the option of continuing the extended warranty (parts and on-site labor) for as long as sixty months from date of start-up (or sixty-three months from date of shipment, whichever is less) after expiration of the two-year extended warranty. This extension is conditional on the maintenance of regular service/maintenance program with a minimum of two visits per year by a manufacturer's service technician.

1.06 EQUIPMENT SUPPORT

A. The manufacturer shall provide support for the equipment for a minimum period of 15 years following shipment of the equipment. This support shall, as a minimum, consist of:

1. Spare parts for superseded equipment
   The manufacturer shall provide spare parts required for the proposed equipment for the full term of the 15-year support period, regardless of whether the equipment remains in current production.

2. Spare parts availability
   The manufacturer shall maintain an inventory sufficient to provide fast shipment of replacement parts. This will include:

   a. Product-specific parts shall be shipped within two weeks of the order
   b. Parts available from sources other than the manufacturer:
      Provide name, address and telephone number of an alternate supplier within 24 hours if the part is not available for shipment by the manufacturer within 48 hours.

3. Fully-trained service technicians
   The manufacturer shall ensure that qualified service technicians are available to assist the owner 24 hours a day, 7 days a week for the full support period. These technicians shall be documented as having successfully completed training in:

   a. Psychrometrics and psychrometric measurements
   b. Methods of dehumidification
   c. Dehumidifier applications
   d. Desiccant dehumidifier performance calculations
   e. Dehumidifier start up and preventive maintenance
   f. Dehumidifier troubleshooting and system diagnosis

PART 2 PRODUCT

2.01 DEHUMIDIFIER

A. Dehumidifier unit casing (for units with desiccant wheels below 61" diameter)
The unit casing shall be fabricated of strain-hardened aluminum with a minimum thickness of 0.125" for torsional rigidity and corrosion resistance. The casing shall be formed, welded and sealed as a single unified structure. Steel construction is not acceptable. Aluminum structures depending on screws for casing construction are not acceptable. In addition, the unit casing shall include:

1. Insulation
To avoid either condensation, heat loss or loss of cooling capacity, the unit casing shall be insulated such that the heat transfer rate through casing walls is less than 0.27 Btu/sq. ft. /°F if the wall separates air streams which differ in temperature by more than 25°F.

2. Wiring
All wiring between dehumidifier components shall comply with the current National Electrical Code (NEC). Wiring unprotected by flexible conduit shall not be acceptable.

3. Process and reactivation air flow gauges
To set and verify the specified air flow rates through the unit, the casing shall be equipped with differential pressure gauges which measure and display the pressure drop across the desiccant wheel. The dial of the gauges shall include a warning zone to indicate when the air flow is above the recommended operating range of the equipment.

4. Coating
The exterior of the unit casing and all surfaces of access panels shall be degreased and cleaned, then primed with one coat of industrial wash primer and finished with one coat of catalyzed polyurethane enamel. All pieces shall be painted individually prior to assembly to assure complete protection.

5. Weather tight construction
The dehumidification unit shall be installed indoors however all access panels shall be weather tight, as shall all joints between casing and electrical conduits and between the unit casing and any components mounted in separate enclosures.

a. Air Inlets
The inlets shall be provided with air flow control dampers.

1) Air flow dampers
Inlets shall be equipped with manual flow control dampers with locking hardware. For air inlets smaller than 15" in height or width, single-blade dampers shall be acceptable. When any inlet dimension exceeds 15", the

manufacturer shall provide opposed-blade dampers with stainless steel end seals, elastomeric edge seals and oil-impregnated blade shaft bushings.

6. Maintenance access and inspection panels
   The unit casing shall include access panels for inspection and for any maintenance required by the operating and maintenance manual. These panels shall be fastened by captive hardware permanently fixed to either the panel or the unit casing. The panels shall be airtight to the extent of not leaking more than 1% of the rated airflow when the interior of the casing is under 5" WC positive air pressure, nor more than 0.5% of the rated flow when the casing is under 5" WC of negative pressure. Panels without gaskets shall not be acceptable. Panels held in place by drill-screws shall not be acceptable. Equipment which requires disassembly of components rather than access through removable panels for any maintenance required by the operating and maintenance manual shall not be acceptable.

7. Filters
   The unit casing shall include removable filters at the inlet of both process and reactivation air streams. These filters shall be mounted on sliding racks and accessible through panels equipped with fast-acting, captive hardware. Pleated type MERV 8 filters shall be provided for both the process and reactivation air streams. Provide five (5) additional spare filters for each size filter required for the unit.

B. Electrical control cabinet
   The electrical control cabinet shall be weather tight to NEMA 4 standards and shall include the following:

1. Single point electrical power connection. Provide a through the door type (interlocked) fused disconnect.

2. Wiring to comply with the current National Electrical Code with further fuse and wiring sizing to meet or exceed UL 508A *Industrial Control Panel.*

3. Wires shall be color-coded or numbered at both ends and all terminal block connection points shall be numbered. These markings shall correspond with the electrical diagram provided in the operating and maintenance manual.

4. Components shall be UL or CSA approved where possible.

5. Programmable logic controller
   The unit sequence of operations shall be controlled by a programmable logic controller which includes separate indication for:

   a. Power on
   b. Unit running
   c. Desiccant wheel rotation fault
   d. Reactivation air overheat after heaters
   e. Reactivation air leaving below set point
   f. Motor overload

6. Operating and maintenance manual
   The control cabinet shall include a copy of the O & M manual, mounted in a separate compartment or pocket to allow access to critical information by maintenance personnel after installation.

7. Run-hour meter
   To allow for recording maintenance practices and to assist fault diagnosis, the cabinet shall have a run-hour meter mounted and visible from the exterior of the unit.

C. Reactivation circuit
   The reactivation circuit shall conform in all respects to the current National Electrical Code.

   1. Direct-fired natural gas reactivation

      a. The direct-fired raw gas burner shall have a rust-resistant cast iron air-fuel manifold and stainless steel air mixing plates. The burner assembly shall be mounted inside a housing constructed of strain-hardened aluminum sheet of 0.125 inch thickness. The housing shall be welded and equipped with internal insulation of fibrous glass with a minimum thickness of 1 inch.

      b. Burners with less than 749 MBH input capacity shall be equipped with a single-stage combination gas valve. The complete pilot ignition system has been A.G.A. design certified to A.N.S.I. Standard Z21.7A-1985 "Automatic Intermittent Pilot Ignition Systems for Field Installation.". Gas valves and ignition control units also are A.G.A. design certified (separately) to applicable A.N.S.I. standards:

Z21.15	Manual Gas Valves
Z21.18	Gas Pressure Regulators
Z21.20/Z21.20A	Automatic Ignition Systems
Z21.21/Z21.21A	Automatic Valves
Z21.35	Gas Filters

      The butterfly valve utilized for gas flow control is a UL recognized component. The actuator provided to modulate the valve is powered by a UL listed Class 2 cover mounted transformer.

      c. Burners with 750 MBH and greater input capacity shall be equipped with a general-purpose ANSI-standard gas train with redundant fluid power valves rated for duty at the specified gas supply pressures.

      d. Reactivation energy shall be automatically matched to dehumidification requirements by means of a modulating gas valve with proportional electric valve actuator. The valve/actuator assembly shall be connected to a temperature sensor/controller mounted in the discharge of the reactivation air stream.

D. Desiccant Wheel

The desiccant wheel media shall be a monolithic, extended-surface contact medium, fabricated entirely of inert, inorganic binders and glass fibers formed into narrow passages in the direction of airflow. The wheel shall be bacteriostatic and non-toxic. It shall also meet the following requirements:

1. Materials: The glass fibers which form the support matrix shall be made from uniform continuous strands larger than five microns in diameter which are nonrespirable and are not considered a possible health risk by the International Agency for Research on Cancer (IARC).

2. Flame spread and smoke generation

   The wheel shall be tested according to ASTM E84-90 (Standard Test Method for Surface Burning of Building Materials) and shall achieve the following results:

   a. Flame spread index = 0
   b. Smoke developed index = 10

3. Desiccant impregnation

   The desiccant shall be evenly impregnated throughout the structure for predictable, consistent performance and for maximum wheel life. Coatings applied on top of the contact medium shall not be acceptable unless the manufacturer can provide independent life tests demonstrating less than a 5% decline in desiccant capacity over a five year period of normal operation.

4. Desiccant type

   The desiccant impregnated into the contact medium shall be:

   a. Titanium-reinforced silica gel

      The Honeycombe® desiccant wheel shall be a fabricated extended surface contact media with a multitude of small passages parallel to the airflow. The rotary structure shall be a monolithic composite consisting of inert silicates with microscopic pores designed to remove water in a vapor phase. The desiccant shall be hydrothermally-stabilized silica gel reinforced with titanium for maximum strength and stability over time. The fabricated structure shall be smooth and continuous having a depth of 400 millimeters in the direction of airflow without interruptions or sandwich layers which restrict air flow or create a leakage path at joining surfaces. Nominal face velocity shall not exceed 600 fpm. The Honeycombe® wheel shall be manufactured in the United States. The manufacturer shall provide documentation to establish that:

      1) The desiccant retains more than 90% of its original capacity after ten years of continuous operation in clean air, with inlet air conditions up to an including 100% relative humidity.

      2) The wheel as impregnated with silica gel is capable of withstanding five complete water immersion cleaning cycles while retaining more than 95% of its original adsorption capacity.

E. Desiccant Wheel Support and Drive Assembly
For wheels of 60" diameter and smaller, the wheel shall be a single piece for fast removal and simple handling. In the smaller case, the desiccant wheel shall be supported by four rollers at the base of the unit so the wheel can be easily removed for maintenance by lifting it over the rollers using the drive belt. Center-axle support or any arrangement which requires disassembly of the support structure for wheel removal shall not be acceptable. In addition, the wheel drive assembly shall provide:

1. Rotation speed
To avoid excessive heat carryover from reactivation to the process air, the wheel rotation speed shall not exceed 10 rph while achieving the required moisture removal rate at the specified conditions.

2. Drive belt
The drive belt shall be the flat, toothed type, with aramid fiber reinforcement.

3. Drive motor
The drive motor shall be fractional horsepower and rated for continuous duty for a period of 20,000 hours under the load conditions imposed by the drive assembly.

4. Rotation detection
The drive assembly shall be equipped with a rotation detection circuit which shuts down the dehumidifier and signals the operator through an indicating light on the control cabinet if the wheel is not rotating.

F. Air seals and internal air leakage
The process and reactivation air streams shall be separated by air seals and internal partitions so that the humid reactivation air does not mix with the dry process air. The proposed equipment shall meet the following minimum requirements:

1. Wheel face seals
For units with desiccant wheels under 61" in diameter, the dehumidifier shall have full-face seals on both the process air entering and the process air leaving sides of the wheel. These shall seal the entire perimeter of both air streams as they enter and leave the wheel. Partial seals shall not be acceptable. The seals shall be the silicone rubber bulb-type, with a protective strip of low-friction, abrasive-resistant tape to extend seal life and reduce the force needed to turn the desiccant wheel. Neither wiper-type seals nor brush-type nor any non-contact-type seal shall be acceptable. The seals shall be documented to have a minimum working life of 25,000 hours of normal operation.

2. Total casing air leakage
The unit shall not allow leakage to exceed the greater of the following values:

a. One percent of the process air flow
b. SMACNA (Sheet Metal & Air Conditioning Contractors National Association) Leakage class 6, which is defined by:

$F = C \times P^{0.65}$
$L = F \times A$

Where:

F = Leakage flow (cfm/sq.ft. housing area)
C = Leakage class (equal to 6)
P = Design static pressure (in. WC)
L = Total leakage (cfm)
A = Housing area (sq.ft.)

c. Determine leakage using the testing methods described by SMACNA Publication 15d, *HVAC Air Duct Leakage Test Manual (Air Distribution Equipment and Ducts)*.

d. Terms are defined as follow:

1) Design static pressure: Maximum positive or negative pressure referenced to the unit exterior (inches W.C.).
2) Design airflow: Maximum unit air flow at the discharge connection (ft^3/min).
3) Housing area: Total area of the unit air containment, including fan wall area (ft^2).

G. Process and reactivation air fans
Process and reactivation air fans shall be the single-inlet, single-width, centrifugal-type.

1. Fan wheel type
Fans driven by motors of 3 hp and below shall be the direct-drive, forward-curve centrifugal type. Fans driven by motors of 2 hp through 7.5 hp shall be backward-inclined, direct-drive centrifugal type. Fans driven by motors of 7.5 hp and larger shall be the backward-inclined, belt-driven centrifugal type.

2. Balancing
Fans shall be balanced after assembly and after coating at the speed the unit is scheduled to operate. Fans shall be balanced such that the maximum displacement in any plane is less than 1.0 mils, peak to peak.

3. Belt-driven fans
For fan motors of 10 hp and smaller, the belt-drive shall be selected for 120% of rated capacity. For fans driven by motors larger than 10 hp, the drive shall be selected for 150% of rated capacity. All belt-driven fans shall be equipped with:

a. Removable belt guards with openings to allow tachometer readings at both fan and motor shafts. Guards shall also be constructed to allow visual inspection of the belts without removing the guard.
b. Vibration isolators, with a minimum efficiency of 95%.

4. Fan motors

Fan motors shall be the totally-enclosed, fan-cooled, high-efficiency type and shall be selected for a service factor of 1.15.

H. Moisture removal capacity control
The dehumidifier shall operate automatically, in response to the control system supplied by the manufacturer as follows:

1. On-off control
The dehumidifier shall turn on and off in response to the sensor specified, which shall be provided by the manufacturer and mounted in the specified location and connected to the dehumidifier by the installing contractor.

2. The system control logic (sequence of operation) shall be controlled by a Siemens S7-1200 Series PLC and shall be provided with the necessary discrete and analog I/O for functional operation of the desiccant wheel, reactivation and process fan. Contacts shall be provided for PLC interface, alarm notification and fault notification. Provide a Siemens Model KTP400 color touch screen HMI for user interface with the PLC and visual display of the system status and operating parameters.
3. The dehumidification unit shall be provided with an electrical on/off condensation controller shipped loose by the manufacturer. The controller shall be installed by the installing contractor.

PART 3 EXECUTION

3.01 INSTALLATION AND START-UP

A. Installation
The dehumidifier shall be installed in accordance with instructions contained in the operating and maintenance manual provided to the installing contractor by the manufacturer at the time of submittal and equipment approval.

B. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

C. Ground Equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Start-up shall be by the Manufacturer
The manufacturer’s service technician shall start up and adjust the unit in accordance with instructions contained in the operating and maintenance manual provided by the manufacturer. Manufacturer’s start-up shall include a start-up labor warranty for ninety (90) days after start-up completion. The manufacturer’s start up technician must pay particular attention to the following items:

1. Air flow

The air flow volume of the process and reactivation air streams shall be set so that the reading on the manometers on the unit matches the values outlined on the technical data sheet provided by the manufacturer.

2. Utilities
   The power and reactivation energy connections shall be made carefully and checked against the unit specifications outlined on the technical data sheet provided by the manufacturer.

3. Documentation
   The manufacturer’s start-up technician shall provide written documentation of compliance with procedures outlined by the manufacturer in the operating and maintenance manual. As a minimum, the technician shall measure and record the values for the electrical power, the air flow manometers and the run-hour meter. The technician’s full name and telephone number and the start-up date shall be printed legibly on the start up documentation and on the copy of the technical data sheet in the operating and maintenance manual which is mounted inside the unit control cabinet.

E. Cleaning: After completing system installation, including outlet fittings and devices, inspect exposed finish. Clean units to remove dirt and construction debris and repair damaged finishes.

F. DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

   a. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units

   b. Review data in maintenance manuals

   c. Schedule training with Owner, through Engineer, with at least fourteen days' advance notice

4.01 QUANTITY AND PAYMENT

A. General

The contractor shall include all associated costs (material and labor) for work outlined in this specification in the appropriate bid item on the bid form. Where the work included in this specification is not specifically identified on the bid form, the contractor shall include the associated costs in the related bid item(s) of which it is a part. All work described in and required by this specification shall be included in the contractors bid, regardless of whether a particular item is specifically identified on the bid form.

END OF SECTION 238419

SECTION 260100 – ELECTRICAL SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Coordination with occupants.

1.2 PROJECT INFORMATION

A. Project Identification: Browning Road Water Treatment Plant Improvements.

1. Project Location: 4400 Frosthoffer Road
Pennsauken Township, NJ 08360

B. Owner: Merchantville – Pennsauken Water Commission

Owner's Representative: Engineer: Remington, Vernick Engineers – (856) 795-9595, attention: Dennis Yoder, PE, email Dennis.Yoder@rve.com, 2059 Springdale Road, Cherry Hill, NJ 08003.

1.3 ELECTRICAL WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists, but not be limited to the following:

1. The project consists of providing a new electrical service and distribution infrastructure throughout the entire plant facility and provide electrical lighting, power, and systems for the new UV Building. The work includes but not limited to: providing new 1200 amp 480Y/277V service entrance distribution equipment, 1200 amp service entrance rated automatic transfer switch, all required electrical connections, raceways, cabling, control wiring, overcurrent protection for all equipment, fire alarm system, lightning protection system, lighting and lighting controls, convenience power, and coordination with all other trades.

2. Prior to executing demolition work the contractor shall completely scan (ground penetrating radar equipment) the plant facility for all underground piping, conduits, direct buried cables and/or underground structures.

3. All work shall include the necessary electrical service entrance demolition, new temporary electrical service rack and distribution ductbanks, for electrical power distribution, overcurrent protection switches, raceways, raceway installation methods, electrical equipment, conductors, etc. as described on the contract drawings.

4. Prepare and provide relocation of the utility company transformer to the front of the Plant property. Work includes new retaining walls and stone bed for PSE&G pad mount transformer. The contractor shall coordinate the installation and transformation with the utility company at no additional cost.

5. Provide a new plant wide (overall) temporary electrical service entrance utility rack with 1200 amp Cold sequence switch, utility C.T. cabinet (PSE&G approved), Utility meter, Solar net meter and connection, 1200 Amp service entrance switch, and Grounding assembly.

6. Provide a new minimum 500 kW diesel powered standby generator suitable of powering the entire plant. The work shall include installation on existing equipment foundation after the existing tanks have been reinstalled in the new building constructed in this project, with a new 1200 amp, 480 volt service entrance rated automatic transfer switch.

7. Provide a new electrical ductbank infrastructure for the entire plant property. This includes new feeders to the existing Main Electrical Building, existing High Service Pump Building, existing Filter Building, existing Solar Farm, and new UV Building.

8. Provide new electrical switchboard with two (2) new 100 horsepower variable frequency drive for the replacement of two high service pumps located in the High Service Pump Building. Provide new raceways and feeders and associated controls for the new pumps.

9. Furnish and install new feeder cables, raceway, and control wiring from the new automatic transfer switch in the new UV Building to the new 500kW diesel generator.

10. Once the new 500kW generator is in full operation demolish the existing 250kW diesel generator and all associated wiring.

11. Restore all existing exterior surfaces to match existing surfaces.

12. The contractor is responsible for providing sheathing and shoring for the protection of the excavation, adjacent structures throughout all excavation and construction activities.

13. It shall be the contractor’s responsibility to coordinate all utility work with PSE&G relating to PSE&G Notification# 501074655. All fee’s for PSE&G have already been provided by the owner.

14. The contractor shall provide As-built drawings at the completion of the project.

1.4 ACCESS TO SITE

A. Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways, and Entrances: Keep driveways, standpipe, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner has the right to occupy the project site and existing buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. All utility electric power disruptions are to be conducted in accordance with the Owner's written permission two weeks prior to disruption, unless otherwise indicated by the owner and building operations manager. All utility electric power disruptions should be minimized and not exceed one hour. Extended utility power disruptions will require a temporary generator as required to maintain power to the building at no additional cost. Maintain existing exits unless otherwise indicated.

END OF SECTION

SECTION 260450 - ELECTRICAL DEMOLITION & RENOVATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCE CODES AND STANDARDS

A. The work shall conform to:

1. National Electrical Code
2. State and Local Codes

PART 2 - PRODUCTS

2.1 Materials used for this work shall be in accordance with the applicable specification sections in Division 16.

PART 3 - EXECUTION

3.1 Provide demolition, relocation, and alteration of electrical construction as required.

A. The contractor shall notify the owner 72 hours in advance of any interruptions of electric service to any area of the building or water treatment plant.

B. All interruptions of electric service shall be kept to a minimum. Where power is to be interrupted, temporary power shall be provided by means of additional temporary feeds or by means of a generator. All costs associated with providing temporary electricity is of the contractor’s responsibility.

C. It is assumed that there will be a plant utility shutdown for the transfer of utility from the existing utility service to the proposed new service entrance for the plant. Formal coordination with the plant management will need to be programmed and approved one week (7 calendar days) prior to the plant shutdown. It shall be a limited predetermined time period acceptable by the management of the Water Treatment Plant and the responsible Project Engineer. The contractor will be required to support all life safety requirements within the entire plant during the shutdown at no additional cost to the owner. The life safety program must be pre-approved by the City Fire Marshal and all local authorities.

D. Should the electrical service be disrupted due to construction while the building is occupied the contractor shall provide temporary electrical power at no additional cost to the contract.

3.2 Check the locations of all existing electrical work, such as lighting fixtures, electrical conduit, wiring, fittings, controls, starters and other electrical construction and provide the removing, relocating, rerouting, and reconnecting of this work due to demolition and new construction. Any existing apparatus or wiring device to be retained shall be disconnected, relocated and reinstalled as required, to allow for new wall, floor or ceiling finishes.

3.3 Methods of installation and standards of workmanship shall be in accordance with the applicable specification sections under Division 26.

3.4 Where existing equipment will remain in service during construction, provide rerouting and reconnection of electrical service as required.

3.5 Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality.

3.6 Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

3.7 Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm), below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

3.8 Remove demolished material from project site. Any particular equipment that the owner wants saved shall be stored as directed.

3.9 Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.10 Feeders or circuits, whether spliced, extended, relocated or new, shall maintain amperage and continuity of that respective feeder or circuit.

3.11 Where new work interferes with existing work or other trades, relocate such existing work without additional cost. Approval by the Owner's Representative must be given before any relocation work can begin. The relocation work shall be done in a manner acceptable to the Owner. Engage Contractor of the appropriate trade to do the work.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260450

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL – MATERIALS AND METHODS GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Utility company electricity-metering components.
6. Concrete equipment bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.

1.2 SUBMITTALS

A. Product Data: For utility company electricity-metering components.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. The contractor shall be fully responsible for all coordination of the electrical work required to meet the design intent and the scope of work related to the project. This includes but not limited to all other trades, material handling, equipment rentals, tools, automobiles, parking and travel expenses, engineering review and consult, as-built drawings and any/all construction site requirements that are necessary to provide a turnkey electrical installation.

C. The ‘Basis of Design’ is the product that is specified which supports the design data contained within the contract documents. Should the contractor elect to use an alternate manufacturer listed within the specifications the contractor is still required to meet the full intent and specifications and the contract documents. Any deviation of the contract documents will be the sole responsibility of the contractor to maintain specification requirements at no additional cost to the owner.

D. It shall be the contractor’s responsibility to acknowledge any long lead delivery items with written response from the manufacturer, at the time of Notice to Proceed. Should the contractor fail to inform the client, and the A/E of any material or equipment delays at the time Notice to Proceed has been given, the contractor will take full responsibility in completing the project in the same allowed construction period, based on the approved construction schedule.

E. The contractor shall be fully responsible for the coordination and installation of all electrical products as per the manufacturer's recommendations. Should the contractor alter or change the manufacturer's installation recommendations, the contractor shall submit a certified installation report from the manufacturer's representative stating the installation is acceptable. Any discrepancies in the installation shall be corrected per the manufacturer's requirements at no additional cost to the owner and before final closeout of the project.

F. Devices for Utility Company Electricity Metering: Comply and coordinate with local utility company requirements and Specification Section 262713 – Electricity Metering.

G. Comply with NFPA 70.

1.4 COORDINATION

A. The contractor shall be fully responsible for the coordination of all electrical work required to meet the design intent and the scope of work related to the project. This includes but not limited to all other trades, material handling, equipment rentals, rigging equipment, cranes, high reach man lifts, tools, automobiles, parking and travel expenses, engineering review and consult, as-built drawings and any/all construction site requirements that are necessary to provide a turnkey electrical installation.

B. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

D. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

E. Devices for Utility Company Electricity Metering: Comply and coordinate with local utility company requirements and published standards.

F. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

G. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of the identification device with completion of the finished surface.

H. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

I. The contractor shall verify all existing conductor phasing for each individual circuit feeder whether it be primary or secondary feeds to and from the new electrical equipment. The contractor is fully responsible for tagging and phasing all branch circuits. Any disruption or equipment failure caused by phase crossing shall be the full responsibility of the contractor to replace and or repair any/all damages that may occur at no additional cost.

J. Coordinate and provide all conductors with the appropriate color coding as required per the Nation Electrical Code regarding the cable type, application and voltage.

1.5 ITEMS NOT SHOWN OR SPECIFIED

A. Any item of material not indicated on the drawings and/or not specified, but which is required for the complete and proper installation and/or operation of any part of the work, shall be provided as if indicated and specified, at no additional cost to the Owner.

B. Any work not indicated on the drawings and/or not specified, but which is required for compliance with applicable codes and regulations, shall be provided as if indicated and specified, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. EMT: Electrical metallic tubing; ANSI C80.3, zinc-coated steel, with compression fittings.

B. FMC: Flexible metal conduit; zinc-coated steel.

C. IMC: Intermediate metal conduit; ANSI C80.6, zinc-coated steel, with threaded fittings.

D. LFMC: Liquidtight flexible metal conduit; zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

E. RMC: Rigid metal conduit; galvanized rigid steel; ANSI C80.1.

F. RNC: Rigid nonmetallic conduit; NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

G. Raceway Fittings: Specifically designed for raceway type with which used.

2.2 WIRES, CABLES, AND CONNECTIONS

A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

B. Conductors, Larger Than No. 10 AWG: Stranded copper.

C. Insulation: Thermoplastic, rated 600 V, 75 deg C minimum, Type THW, THHN-THWN, or USE depending on application.

D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating.

B. Metal Items for Use Outdoors or in Wet or Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs. Strength rating to suit structural loading.

D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.

1. Materials: Same as channels and angles, except metal items may be stainless steel.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).

C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:

1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
2. Embedded continuous metallic strip or core.
3. Printed legend that indicates type of underground line.

F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.

G. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.

1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.
2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch (1-mm), galvanized-steel backing. 1/4-inch (6-mm) grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Comply with requirements of the local electrical power utility company for meter sockets and current transformer cabinet and as per Specification Section 262713 – Electricity Metering.

B. Provide Cold Sequence Meter Protection Switch as required by the Local Utility Company.

C. The contractor shall coordinate and provide any/all metering equipment for low and medium voltage equipment provisions not directly supplied by the local utility company.

2.6 CONCRETE BASES

A. Provide 6” high concrete sub-bases for all floor mounted electrical equipment within spaces that are below exterior finished grade and/or in spaces that are installed where water or liquids may be dispersed from local equipment or building appurtenances.

B. Where concrete bases are required, provide approved anchoring systems and methods to apply the base to the flooring and for the equipment being supported.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Electrical equipment shall be installed at elevations where the disconnecting means is not greater than 6'-6" above the accessible, working floor elevation (unless noted otherwise).

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY APPLICATION

A. Outdoor Installations:

1. Exposed: RMC.
2. Concealed: RNC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4, unless otherwise indicated.

B. Indoor Installations:

1. Exposed: EMT except in wet or damp locations, use IMC.
2. Concealed in Walls or Ceilings: FMC.
3. In Concrete Slab: RNC.
4. Below Slab on Grade or in Crawlspace: RNC
5. Connection to Vibrating Equipment: FMC; except in wet or damp locations: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.3 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Keep legs of raceway bends in the same plane and keep straight legs of offsets parallel.

C. Use RMC elbows where RNC turns out of slab.

D. Where required to provide a Rough-in Only device application concealed within the vertical walls the contractor shall provide the device work box and ¾" EMT raceway to above the ceiling with a 90 degree bend turned into the ceiling space and apply an open end plastic bushing or cap for future wiring application.

E. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or woven polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wires.

F. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inches (1830-mm) flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Application: Use wiring methods specified below to the extent permitted by applicable codes as interpreted by authorities having jurisdiction.

B. Exposed Feeders: Insulated single conductors in raceway.

C. Concealed Feeders in Concrete: Insulated single conductors in PVC raceway.

D. Exposed Branch Circuits Insulated single conductors in raceway.

E. Concealed Branch Circuits: Insulated single conductors in FMC raceway.

F. Underground Feeders and Branch Circuits: Insulated single conductors in raceway.

G. Remote-Control Signaling and Power-Limited Circuits, Classes 1, 2, and 3: Insulated conductors in FMC raceway unless otherwise indicated.

H. Provide PVC pipe sleeves for all non-fire rated interior masonry and below grade wall penetrations. Provide caulk/sealant of all wall penetrations installed.

I. Provide Rigid metallic pipe sleeves for all fire rated masonry and exterior wall penetrations. Provide the rated fire caulk/sealant for all wall penetrations that match the rating of the fire wall.

3.5 WIRING INSTALLATION

A. The contractor shall minimize all wire splices or taps. Should the need to provide splices or taps provide materials that are compatible with the connecting conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

B. Unless specified otherwise the contractor shall not exceed four (4) current carrying conductors plus ground in a single raceway.

3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

B. Dry Locations: Steel materials.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb (90-kg) minimum design load for each support element.

3.7 SUPPORT INSTALLATION

A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.

C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps.

D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used in existing walls or floors. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:

1. Wood: Wood screws or screw-type nails.
2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.
3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.
4. New Concrete: Concrete inserts with machine screws and bolts.
5. Existing Concrete: Expansion bolts or threaded studs driven by powder charge and provided with lock washers.
6. Structural Steel: Welded threaded studs.

    a. Comply with AWS D1.1 for field welding.

7. Light Steel Framing: Sheet metal screws.
8. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.
9. Light Steel: Sheet-metal screws.
10. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.8 FIRESTOPPING

A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies.

3.9 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety and back to electrical panel source.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.10 TEMPORARY ELECTRICAL POWER / SERVICES

A. Provide all necessary temporary electrical construction power by either a temporary service power pole or by portable generator to maintain adequate electrical power requirements for the duration of construction, at no additional cost to the project or owner.

B. Should the project include demolition or disruption of an existing electrical service the contractor shall provide temporary back-up power source and connection that meets the demand requirements of the disturbed service at no additional cost to the project or owner.

3.11 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms ″Listed″ and ″Labeled″ as defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A ″Nationally Recognized Testing Laboratory″ as defined in OSHA Regulation 1910.7.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

2.2 CONDUCTORS AND CABLES

A. Manufacturers:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Rome Cable Company.
4. Southwire
5. Or equal

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THW, THHN-THWN, XHHW and SO complying with NEMA WC 5 or 7.

E. Conductor Insulation Type: Type XHHW or XHHW-2 used for exterior and below grade or in extreme wet location areas.

F. Multi-conductor Cable: Armored cable Type FAC, Metal-clad cable Type FMC, and Type SO with ground wire. Armor shall be steel interlocked covering in NEMA 1 applications. Type SO cable shall be pre-approved for the application by the Engineer.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.4 HEAT TRACE CABLES AND COMPONENTS

A. Provide a heat trace freeze protection system for above ground piping with a minimum rating of -20°F. Basis of Design: Raychem by Tyco Thermal Controls.

Other Approved Manufacturers:

1. Nelson Heat Trace – Emerson Industrial Automation

B. The Raychem XL-Trace System shall be provided with all required control monitoring devices and 30-mA ground fault protection device.

C. System shall be UL listed and FM approved for non-hazardous locations. Where hazardous locations apply comply with all current NFPA and EPA requirements.

D. The self regulating, Raychem 12XL2 (12 watt/ft) heating cable shall be permanently secured to the metallic pipes with Raychem GT-66 glass reinforced tape. The cable shall be minimum 20 amp, 208 volt rated.

E. For above ground system include the following devices:
   1. Power Connector – RayClip-PC
   2. Electronic thermostat – Raychem model EC-TS-AM8.
   3. Splices – RayClic-S
   4. Tees – RayClic-T
   5. End seal – RayClic – E
   6. Provide all miscellaneous installation components required by the manufacturer for a turnkey installation.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type XHHW and XHHW-2, single conductors in raceway.

B. Exposed Feeders in raceway: Type THHN-THWN. Unless noted otherwise.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in EMT, FAC or FMC raceway.

D. Feeders, Concealed in Concrete or below Slabs-on-Grade: Type THHN-THWN, single conductors in PVC raceway.

E. Feeders, Wet locations: Type XHHW and XHHW-2, single conductors in raceway

F. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway that meets the crawlspace environment (no FAC or FMC).

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Electrical Metallic Tubing Type EMT, Armored cable Type FAC, or Metal-clad cable Type FMC.

H. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in PVC raceway.

I. Branch circuit homeruns exposed: Type THHN-THWN, single conductors in EMT or RMC.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord sized in accordance with the overcurrent protection device (breaker or fuse size) ‘not’ the amperage rating of the appliance.

K. Exposed Fire Alarm Circuits: Type THHN-THWN, in raceway or Power-limited, fire-protective, signaling circuit cable in steel armor spiral cover, colored red or labeled EMT.

L. Exposed Fire Alarm Circuits where existing architecturally finished wall surfaces exist to remain, the contractor shall provide Surface Mounted Raceway (such as Wiremold).

M. Class 1 Control Circuits: Type THHN-THWN, in raceway.

N. Class 2 Control Circuits: Power-limited cable, concealed in building finishes (above acoustical ceilings and walls).

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers & Supports"

F. Provide an additional four hundred linear feet of cable/conductor and accessories of each type and size used on the project to accommodate any changes required to resolve interferences as directed by the Engineer.

G. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

H. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
3. It is the electrical contractor's responsibility to confirm all wire and cable installations meet the necessary inspections and testing indicated in item 260519-3.4A paragraph #2 of this section. Should any failures be found during or immediately after construction the contractor will be required to provide and third-party NETA testing agency to prepare a detailed inspection and approval report detailing all corrective measures at no additional cost. In addition, the contractor will be required to replace 100% of all damaged or failing installations at the contractor's expense. Should any work require replacement the contractor will be required to provide at no additional cost another NETA testing inspection to confirm corrective measure have been met.

B. Test Reports: Prepare a written report to record the following should 260519-3.4A paragraph #3 be required:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

A. Product Data: For ground rods and chemical rods.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Ground Rods-Provide an additional 3 ground rods of each type and size utilized on this project.
2. Ground Conductors-Provide an additional 150 feet of each ground conductor type and size utilized on this project.
3. Ground Connections-Provide an additional 6 connections of each type and size utilized on this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Apache Grounding/Erico Inc.
2. Boggs, Inc.
3. Chance/Hubbell.
4. Copperweld Corp.
5. Dossert Corp.
6. Erico Inc.; Electrical Products Group.
7. Framatome Connectors/Burndy Electrical.
8. Ideal Industries, Inc.
9. ILSCO.
10. Kearney/Cooper Power Systems.
11. Korns, C. C. Co.; Division of Robroy Industries.
12. Lightning Master Corp.
13. O-Z/Gedney Co.; a business of the EGS Electrical Group.
14. Raco, Inc.; Division of Hubbell.
15. Robbins Lightning, Inc.
16. Salisbury, W. H. & Co.
17. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

L. Ground Conductor for Overhead Distribution: No. 4 AWG minimum, soft-drawn copper.

M. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

N. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Compression type or exothermic-welded type, in kit form, selected per manufacturer's written instructions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

B. Ground Rods: Sectional type; copper-clad steel.

1. Size: **3/4 by 120 inches (19 by 3000 mm)** in diameter.

C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.

E. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

1. Install insulated equipment grounding conductors in feeders and branch circuits.
2. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

3. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
4. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
5. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install an insulated equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
6. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
7. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
8. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install an insulated equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
9. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

    a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
    b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

10. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing an insulated equipment grounding conductor with supply branch-circuit conductors.
11. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

G. Metal Frame Grounding for Buildings: Drive a ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart. Connect rod to column with an underground grounding conductor. Interconnect ground rods with a continuous underground conductor, extending around the perimeter of the building, 24 inches (600 mm) minimum from building foundation. Use tinned-copper conductor not less than No. 2/0 AWG for underground conductor and bury 18 inches (450 mm) below grade, minimum.

H. Building Ground Rings: Provide a perimeter ground ring for the entire building as required per the National Electrical Code Article 250.66C.

I. Bond all concrete encased electrode (foundation/footing reinforcing) Provide as required per National Electrical Code Article 250.66B.

J. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until the tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

K. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

L. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

M. Metal Water Service Pipe: Provide 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 by grounding clamp connectors. Where a dielectric main water fitting is installed, connect the grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

N. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

O. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

P. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

Q. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

R. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

S. Overhead Line Grounding: Comply with IEEE C2 except where stricter requirements are indicated. Use 2 or more parallel ground rods if a single ground rod electrode resistance to ground exceeds 25 ohms.

1. Drive ground rods to a depth of 12 inches (300 mm) below finished grade in undisturbed earth.
2. Ground Rod Connections: Use clamp-type connectors listed for the purpose for underground connections and connections to rods.
3. Lightning Arresters: Separate arrester grounds from other grounding conductors.
4. Secondary Neutral and Tank of Transformer: Interconnect and connect to grounding conductor.
5. Protect grounding conductors on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

T. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor in the duct bank.

U. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a 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 tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, non-shrink grout.

V. Connections to Manhole Components: Connect 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 conductor. Train the conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

W. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches (450 mm) below grade and 6 inches (150 mm) from the foundation.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Nominal maximum values are as follows:

    a. Equipment Rated 500 kVA and Less: 10 ohms.
    b. Equipment Rated 500 to 1000 kVA: 5 ohms.
    c. Equipment Rated More Than 1000 kVA: 3 ohms.
    d. Overhead Distribution Line Equipment: 25 ohms.
    e. Substations and Pad-Mounted Switching Equipment: 5 ohms.
    f. Manhole Grounds: 10 ohms.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260526

SECTION 260529 - 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 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five (5) times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of 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.
      f. Unistrut; Tyco International, Ltd.

   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. 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, provide products by one of the following:

         1) Hilti Inc.
         2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         3) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of 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; a division of Illinois Tool Works, Inc.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type 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.

2.2 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 Division 05 Section "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 except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 3/8 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.

   1. Secure raceways and cables to these supports with two-bolt conduit clamps and/or single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. 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 (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "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. Provide an additional 20 metal supports with required fasteners of each size and type used on the project to accommodate any changes required to resolve interferences or directed by the Engineer..

D. 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 (100 mm) 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 4000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete"

C. Anchor equipment to concrete base.

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 (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260529

SECTION 260533 – RACEWAYS & BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts" for exterior ductbanks, manholes, and underground utility construction.
2. Division 26 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT (PVC): Electrical nonmetallic tubing.

C. FAC: Flexible armored conduit.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible metal conduit.

H. RMC: Rigid Metal Conduit.

I. RNC (PVC): Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturer:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type up to 1-1/2 in. conduit, 2 in. and larger use set screw type.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

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. AFC Cable Systems; a part of Atkore International.
    b. Anamet Electrical, Inc.
    c. Arnco Corporation.
    d. CANTEX INC.
    e. CertainTeed Corporation.
    f. Lamson & Sessions.
    g. RACO; Hubbell.
    h. Thomas & Betts Corporation; A Member of the ABB Group.

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. ENT: Comply with NEMA TC 13 and UL 1653.
2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
3. LFNC: Comply with UL 1660.

C. Nonmetallic Fittings:

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. AFC Cable Systems; a part of Atkore International.
    b. Anamet Electrical, Inc.
    c. Arnco Corporation.
    d. CANTEX INC.
    e. CertainTeed Corporation.
    f. Lamson & Sessions.
    g. RACO; Hubbell.
    h. Thomas & Betts Corporation; A Member of the ABB Group.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
4. Fittings for LFNC: Comply with UL 514B.
5. Pipe Solvents and Adhesives: As recommended by conduit manufacturer.

2.4 METAL WIREWAYS

A. Manufacturer:

1. Hoffman.

2. Square D.

.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 or 3R.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, plastic edge covers, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Screw cover type, Flanged and gasketed type at exterior.

F. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard grey finish coat.

1. Manufacturer:
   a. Legrand
   b. Panduit.

B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

C. Surface Non-Metallic Raceways: Polyvinyl with snap-on covers. Finish with manufacturer’s light ivory color. Note, see drawings for locations where acceptable, provide metallic unless noted otherwise.

1. Manufacturer:
   a. Hubbell Inc.
   b. Legrand
   c. Panduit

D. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

1. Single channel polyvinyl (raceway for branch circuit power and/or low potential services shall be Premise Trak (Latching) as manufactured by Hubbell.
2. The two-piece single channel shall consist of a base section, 5 feet length, latching snap on cover, 0.38 in 2 channel base. Provide 1-gang or 2-gang boxes as required. Apply channel with mechanical fasteners. Adhesives and tapes are NOT acceptable.
3. Two channel polyvinyl raceway for branch circuit power and low potential services shall be Wall Trak as manufactured by Hubbell.
4. The two-piece, two channel raceway shall consist of a base section, 5 feet length, latching snap on cover, 0.81 in 2 and 0.79 in2 channel bases. Provide 1-gang or 2-gang boxes as required. Apply base with mechanical fasteners. Adhesives and tapes are NOT acceptable.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturer:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Com.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.7 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard gray paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid galvanized steel: RMC or IMC.

2. Concealed: Rigid galvanized steel or IMC.
3. Underground, Single Run: RMC or RNC.
4. Underground, Grouped: RMC or RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or 4.

B. Indoors:

1. Exposed: EMT, surface metal raceway.
2. Concealed: EMT, FAC, FMC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
4. Damp or Wet Locations: Rigid galvanized steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4..

C. Minimum Raceway Size: 3/4-inch trade size (DN 21)

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 26 Section "Hangers & Supports."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Provide an additional one hundred feet of raceway and accessories of each type and size used on the project to accommodate any changes required to resolve interferences as directed by the Engineer.

G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

H. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

I. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Change from nonmetallic tubing to Schedule 40 nonmetallic conduit, rigid steel conduit, or IMC before rising above the floor.

J. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

K. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

L. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

N. Telephone and Signal System Raceways, 2-Inch Trade Size (DN 53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Q. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

R. Provide five additional boxes (floor, junction, etc.) and accessories of each size and type used on the project to accommodate any changes required to resolve interferences as directed by the Engineer.

S. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

T. Set floor boxes level and flush with finished floor surface.

U. Set floor boxes level. Trim after installation to fit flush with finished floor surface.

V. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Flexible nonmetallic duct.
4. Duct accessories.
5. Polymer concrete handholes and boxes with polymer concrete cover.

1.2 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

C. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. 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 and Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Acceptable Manufacturer:
1. ARNCO Corp
2. Cantex Inc.
3. Certain Teed Corp.
4. Condux Internations, Inc.
5. Crown Line Plastics
6. ElecSys, Inc.
7. Electri-Flex Co.
8. Lamson & Sesions
9. National Pipe & Plastics
10. Or equal

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 FLEXIBLE NONMETALLIC DUCTS

A. HDPE Duct: Type EPEC-40 HDPE, complying with NEMA TC 7 and UL 651A.
   1. ABB, Electrification Products
   2. ARNCO Corp.
   3. National Pipe & Plastics
   4. Premier Conduit
   5. Or equal

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.4 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
   1. ABB, Electrification Products
   2. Allied Tube & Conduit
   3. Cantex Inc.
   4. IPEX USA LLC
   5. PenCell Plastics
   6. Underground Devices, Inc.
   7. Or equal

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.5 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

B. Acceptable Manufacturers:
   1. Armorcast Products Co.
   2. MacLean Highline
   3. Oldcastle Infrastructure
   4. Quazite, Hubbell Inc. (Basis of Design)

C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

D. Color: Gray.

E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, "ELECTRIC."

I. 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.

J. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

K. Handholes shall have factory-installed inserts for cable racks and pulling-in irons.

2.6 SOURCE QUALITY CONTROL

A. 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. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   2. 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 duct, duct bank, 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.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct 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 and duct bank will drain to manholes and handholes, and as approved by Architect.

3.2 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Feeders 600 V and Less: RNC Type EPC-40-PVC, concrete-encased unless otherwise indicated.

B. Duct for Electrical Feeders 600 V and Less: RNC Type EPC-40-PVC, direct-buried unless otherwise indicated.

C. Duct for Electrical Branch Circuits: RNC Type EPC-40-PVC, direct-buried unless otherwise indicated.

D. Bored Underground Duct: Type EPEC-40 HDPE unless otherwise indicated.

E. Underground Ducts Crossing Paved Paths and Walks direct-buried unless otherwise indicated.

F. Underground Ducts Crossing: Driveways, Roadways and Railroads: RNC Type EPC-40 PVC, encased in reinforced concrete.

G. Stub-ups: Concrete-encased RNC and GRC.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area immediately after backfilling is completed.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. 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."

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to "Cutting and Patching" Article in Section 017300 "Execution."

3.4 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 36” when used for Fiber Optic Cable, both horizontally and vertically, at other locations unless otherwise indicated.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct 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 crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.

H. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches (150 mm) o.c. for 4-inch (100-mm) duct, and vary proportionately for other duct sizes.

I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet (3 m) 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 RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

K. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.

L. Concrete-Encased Ducts and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
4. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. 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. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
8. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
9. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

10. 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.
11. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inches (50 mm) between duct of like services, and 4 inches (100 mm) between power and communications ducts.
12. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
13. 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 duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation applications.

M. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
4. Depth: Install top of duct at least 18 inches (900 mm) below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. 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.
8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
9. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
10. After installing first tier of duct, 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 the last tier, hand place backfill to 4 inches (100 mm) over duct 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 (75 mm) of sand as a bed for duct. Place sand to a minimum of 6 inches (150 mm) above top level of duct.
    b. Place a minimum of 6 inches (150 mm) of engineered fill above concrete encasement of duct.

N. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 6” below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.5 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 duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, 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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.

D. Install handholes and boxes with bottom below frost line, <Insert depth of frost line below grade at Project site> 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 duct 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 brick masonry pavers 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. The bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, 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 12-inch- (300-mm-) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
3. Test 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.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump.

1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260543

SECTION 260553 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

A. Provide product data information on products used.

1.4 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

1. Color: Black letters on orange field.
2. Legend: Indicates voltage and service.

B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend over-laminated with a clear, weather- and chemical-resistant coating.

C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

D. Consider alternatives before specifying self-adhesive product in paragraph below. See Editing Instruction No. 1 in the Evaluations.

E. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).

F. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

G. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

H. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- (0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

2.2 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.3 kg) minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: According to color-coding.

B. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.

4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Circuits with More Than 600 V: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:

1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to conduits concealed within wall.
3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
4. Entire surface of exposed conduits.

F. Install painted identification according to manufacturer's written instructions and as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.
2. Prime surfaces using type of primer specified for surface.
3. Apply one intermediate and one finish coat of enamel.

G. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:

1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
3. Apply the following colors to the systems listed below:
   a. Fire Alarm System: Red.
   b. Fire-Suppression Supervisory and Control System: Red and yellow.
   c. Combined Fire Alarm and Security System: Red and blue.

d. Security System: Blue and yellow.
e. Mechanical and Electrical Supervisory System: Green and blue.
f. Telecommunication System: Green and yellow.

H. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

I. Circuit Identification Labels on Boxes: Install labels externally.

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
2. Concealed Boxes: Plasticized card-stock tags.
3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

J. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm) overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

K. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder, and branch-circuit phase conductors:

1. 208/120-V Conductors:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
2. 480/277-V Conductors:
   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow
3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
   a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
   b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

L. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.

1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties.
3. Band Fasteners: Integral ears.

M. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

N. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

O. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Electrical switchgear and switchboards.
4. Emergency system boxes and enclosures.
5. Disconnect switches.
6. Enclosed circuit breakers.
7. Motor starters.
8. Push-button stations.
9. Power transfer equipment.
10. Contactors.
11. Remote-controlled switches.
12. Control devices.
13. Transformers.
14. Power-generating units.
15. Telephone switching equipment.
16. Clock/program master equipment.
17. Fire alarm master station or control panel.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 260553

SECTION 262200 - LOW-VOLTAGE DRY TYPE DISTRIBUTION TRANSFORMERS – DOE 2016

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install dry type isolation transformers of the types, sizes and quantities indicated on the contract drawings. Provide all lugs, accessories and mounting hardware necessary for proper installation and operation.

B. It shall be the contractor's responsibility to confirm all existing and future access openings and proper ventilation to properly install the transformer in the designated locations. Should the contractor require any alterations to the building structure or require the dismantling of the transformer provided to meet this requirement the contractor shall provide this work at no additional cost.

1.2 RELATED DOCUMENTS

A. All drawings and general provisions of the Contract including General and Supplementary Conditions apply to this section.

1.3 SUBMITTALS

A. Provide product information prior to fabrication and installation. Product data shall include all dimensions, weights, electrical ratings, wiring diagrams and required clearances.

B. When requested, provide additional product data and certifications necessary to show conformance with this specification.

C. Provide information for record purposes including field test reports and maintenance data as required.

1.4 RELATED STANDARDS

A. Provide transformers in accordance with the following standards, where applicable:
   1. Underwriter's Laboratory 1561, Standard for Safety for Dry-Type General Purpose and Power Transformers
   2. Underwriter's Laboratory 506, Standard for Safety for Specialty Transformers
   3. NEMA ST 20, Dry Type Transformers for General Applications
   4. NEMA 250, Enclosures for Electrical Equipment (1000 V Max)
   5. ANSI / IEEE C57.12.91, Standard Test Code for Dry-Type Distribution and Power Transformers
   6. U.S. Department of Energy 10 CFR Part 431 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, dated April 18, 2013. These efficiency standards shall take effect January 1, 2016. All transformers covered in the scope of this document and this specification, manufactured after December 31, 2015, shall be compliant with the new standard.

B. Manufacturer Seismic Qualification: The low voltage general purpose dry type transformer (1000kVA max.) shall meet and be certified to seismic requirements specified in the IBC 2009 International Building Code.
   1. The low voltage general purpose dry type transformer shall be compliant with IBC 2009 parameters.
      a. Ip – Importance Factor: 1.5 – Components must function after an earthquake for life safety purposes (Building Occupancy Code IV).

b. Sds – For ventilated transformers Sds is <=2.00g as standard up to 1000kVA. Encapsulated transformers Sds is 2.00g
c. z/h – Height factor ratio: 1.00 Note: Ratio is a calculated value equal to the floor the gear is installed on divided by 12. A 6th floor installation is a 0.5 value. A basement or ground floor installation is a 0.0 value.

2. Equipment shall be designed to be located in a concrete and steel, moment-resisting frame building not exceeding 12 stories in height with a minimum story height of 10 feet.]

1.5 QUALITY ASSURANCE

A. The manufacturer shall have produced similar electrical equipment for a minimum period of 10 years.

B. Products shall be listed by Underwriters Laboratories, Inc.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle transformers in accordance with manufacturer's recommendations. Utilize factory provisions for all lifting, rigging, or hoisting.

B. Store transformers prior to installation in a temperature and humidity-controlled space. If such a space is not available, apply temporary heat in accordance with the manufacturer's instructions within each ventilated type transformer case to exclude moisture and condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The low voltage, dry type transformer(s) shall be supplied by Siemens or pre-approved equal. Approved manufacturers are as follows:
1. Siemens
2. Square D
3. Cutler Hammer
4. General Electric
5. Or equal

B. Transformers specified in this Section and power distribution equipment feeding and being fed by the transformers shall be warranted and serviced by the same manufacturer. The manufacturer shall have a local field service organization available on an as needed basis.

2.2 GENERAL REQUIREMENTS

A. Transformers shall be of the general purpose, self-cooled, two winding, dry type designed for 60 Hz operation. Transformers shall be designed, manufactured and tested in accordance with the latest ANSI, NEMA and IEEE Standards and shall be listed and labeled in accordance with UL 1561.

B. Insulation System
1. Transformers 15 KVA and larger shall be of the ventilated type and have a UL recognized 220°C insulation system. The temperature ratings shall be based on an allowable 115°C winding temperature rise above a 30°C hot spot and 40°C ambient.
2. Transformer design KVA rating shall be suitable for a 30°C average, 40°C maximum ambient temperature.

C. Core And Coil
   1. Core construction shall be of non-aging electrical grade grain-oriented silicon steel with high permeability, low hysteresis and low eddy current losses as needed to achieve these efficiency levels. Core laminations shall be tightly assembled, and magnetic flux densities shall be kept well below the saturation point.
   2. Windings shall be wound of high-quality aluminum.
   3. Ventilation of windings shall be accomplished by insulated spacers installed and arranged to brace coil layers and provide maximum ventilation. Core and coil assemblies shall be constructed to provide short circuit withstand capability as defined by ANSI and NEMA standards. The complete assembly shall be installed on vibration dampening pads to reduce noise and securely bolted to the enclosure base. A flexible grounding conductor shall be installed between the core and coil assembly and the transformer enclosure.
   4. Core and coil sealing process:
      a. The complete core and coil assembly shall be impregnated with non-hydroscopic thermo-setting polyester varnish to provide a high dielectric and flame-retardant seal.
      b. The shield of varnish to the coils shall effectively impregnate the entire core and coil assembly that results in a unit which is virtually impermeable to moisture, dust, dirt, salt air, other industrial contaminants and provide high dielectric seal as well as fungus resistant.
   5. Core lamination clamping angle shall be of adequate thickness and hardness to insure a tight and rigid core assembly to eliminate movement of core plates. Welded core designs shall include multiple beads as necessary to insure a tight and rigid core assembly to eliminate core plate movement.
   6. Provide full capacity taps in the high-voltage windings as follows:
      a. 15 KVA through 500 KVA step-down transformers: 2 – 2½ % full capacity above normal and 4 – 2½ % full capacity below normal.
      b. 750 KVA and above step-down transformers: 2 – 2½ % full capacity above normal and 2 – 2½% full capacity below normal.
      c. Step-up and dual primary transformers: Provide NEMA standard taps.

D. Enclosures
   1. Ventilated enclosures shall be of heavy gauge steel construction of NEMA 3R construction for outdoor use with the addition of weather shields. Front and rear covers shall be removable to provide access to terminal compartment(s). Terminals shall be fully sized to carry the transformer full load current and shall be arranged to accept UL listed cable connectors.
   2. Enclosure wiring space and positioning of terminals shall allow for adequate cable bending space.
   3. Finish enclosures in ANSI 61 gray paint.
   4. Each transformer shall have a securely attached nameplate providing complete electrical ratings, wiring diagram, tap connections and catalog number, as applicable.

E. Sound
   1. Unless otherwise specified, sound levels shall be in accordance with values allowed by NEMA ST-20.

F. Accessories
   1. Provide weather shields for ventilated transformers installed outdoors conforming to the requirements of NEMA 250, Type 3R All insulating materials are to exceed NEMA ST20 standards and be rated for 220°C UL component recognized insulation system.

2.3 PACKAGED PANELBOARD AND TRANSFORMER

A. Transformers 15kVA and larger shall be 150ºC temperature rise above 40ºC ambient. Transformers 25kVA and larger shall have a minimum of 4 - 2.5% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.
B. The maximum temperature of the top of the enclosure shall not exceed 50ºC rise above a 40ºC ambient.
C. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accord with NEMA TP2.
D. The transformer(s) shall be rated as indicated in the following schedule:
Identification Number(s)
kVA Rating
Voltages
Phase
Frequency

2.3.1 CONSTRUCTION

A. Transformers are to be encapsulated using a sand-epoxy resin mixture to provide maximum protection against moisture, dust and corrosive environments.
B. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating.
C. The core of the transformer shall be grounded to the enclosure by means of a grounding conductor sized in accordance with applicable UL and NEC standards.
D. The packaged panelboard and transformer enclosures shall be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating color shall be ANSI 49.
E. All transformers shall have a minimum 2-5% full capacity primary taps below normal and shall be rated 115°C temperature rise above 40°C maximum ambient. All insulating materials shall be in accordance with current ANSI C89.2 and NEMA ST20 standards for a 185°C UL component recognized insulation system.
F. Packaged power supplies shall include integrally mounted and wired primary and secondary main circuit breakers in accordance with the National Electrical Code requirements.
G. Branch circuit breakers shall be Square D Type QO QWIK-GARD or equal. All breakers shall be plug-in type. Trip indication shall be clearly shown by the breaker handle taking position between ON and OFF when the breaker is tripped and the VISI-TRIP indication consisting of a highly visible red tripped circuit indication.
H. A hinged access door shall be provided which maintains itself in the open position when desired, and which has padlock provisions.
I. The packaged transformer and panelboard shall constructed as separate enclosures capable of being assembled or disassembled as independent units.

2.3.2 SOUND LEVELS

A. Sound levels shall be warranted by the manufacturer not to exceed the following: 5 to 50KVA - 45dB.

2.3.3 OPTIONAL ACCESSORIES

A. Provide weather shields for units installed in damp or wet locations.
B. Provide wall mounting brackets as required for space compliance for units.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per manufacturer’s recommendations and contract documents.

B. Install units plumb, level and rigid without distortion

3.2 ADJUSTMENTS AND CLEANING

A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by the manufacturer.

B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

3.3 TESTING

A. Include the following minimum inspections and tests according to the manufacturer’s written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.

B. Inspect accessible components for cleanliness, mechanical and electrical integrity and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.

C. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.

3.4 WARRANTY

A. The equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION

SECTION 262416 – PANELBOARDS & SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.
2. Distribution switchboards.
3. Transient voltage surge suppressor panelboards.

B. Related Sections include the following:

1. Division 26 Section "Fuses."

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switchboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard, switchboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Field Test Reports: Submit written test reports and include the following:

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.

D. Panelboard and Switchboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," 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.

F. Should the contractor submit any substitution (including other approved manufacturers) other than the specified product the contractor shall be responsible for all electrical, mechanical, structural, and architectural revisions as required to accommodate the installation of the substituted equipment at no additional cost to the owner.

1.5 QUALITY ASSURANCE

A. Comply with NEMA PB 1.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of switchboards, panelboards and associated components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

A. Keys: Four spares of each type of panelboard cabinet lock. Key all cabinets alike.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corp.; Cutler-Hammer Products.
b. Schneider Electric - Square D Co. (Basis of Design)
c. General Electric
d. Or equal

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush- and surface-mounted cabinets as noted on the drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Hinged Front Cover: For boxes more than 28 inches high, entire front trim hinged to box and with standard door within hinged trim cover.

D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

F. Bus: Hard-drawn copper, 98 percent conductivity.

G. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.

H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

K. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.

L. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads as noted on the drawings.

M. Split Bus: Vertical buses divided into individual vertical sections.

N. Gutter Barrier: Arrange to isolate individual panel sections.

O. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. Provide wire feed same size as feeder.

P. Provide ARC Flash labeling as required by the National Electrical Code.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

C. Contractor shall confirm from local utility company prior to submittal review of minimum symmetrical short circuit rating requirements within project site, should the contract documents differ the contractor shall submit and provide the greater rated value.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

C. All panelboards shall be fully equipped with all branch breaker mounting assemblies.

D. All panelboards shall be fully equipped with a grounding bus bar assembly which must be large enough to meet a minimum of 100% of the branch circuit quantities plus 10%.

E. All panelboards shall be fully equipped with a neutral bus bar assembly which must be large enough to meet a minimum of 100% of the branch breaker quantities plus 10%.

2.5 CLASS 2 LIGHTING PANELS – WITH CONTROL SYSTEM

Lighting Control System

A. The lighting control system shall consist of microprocessor-based control electronics with remotely operated circuit breakers mounted to a UL67 listed lighting panelboard interior and enclosed in a UL50 listed panelboard enclosure. The circuit breakers shall provide overcurrent protection, and have an AIR rating or series connected rating that meets or exceeds the fault current of the system to which the panelboard is being applied.

B. Each master control panel shall meet or exceed the following capabilities:

1. Sixteen (16) 2-wire input terminals for connection to external low voltage switch contacts.
2. Time of day scheduling to automatically shut off lighting at specific programmed times
3. Direct control of branch circuits in a master/slave sub-net configuration.
4. Provide true status feedback by monitoring branch circuit breaker status based on actual system voltage at load side terminal.
5. Accept remote commands through the facilities Ethernet infrastructure.

C. All lighting control components shall be installed in a conventional panelboard 20 inches wide or column-width enclosures (as noted on drawings). Suitable barriers shall be installed to separate Class 2 wiring from power conductors.

2.6 DISTRIBUTION SWITCHBOARDS

A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike. Door-in-door construction.

B. Main Overcurrent Protective Devices: Circuit breaker as noted. Main lugs only unless otherwise noted.

C. Branch overcurrent protective devices shall be one of the following:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.7 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for ALL heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
5. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
6. Lock-on clips: Install on circuit breakers for alarm, telecommunications, control systems, and refrigeration equipment.
7. Shunt Trip Device: Integrally mounted relay and trip unit with manual reset ONLY. In addition to the designated locations indicated on the contract documents it shall be required to provide a shunt trip device for any/all elevator and escalator equipment and systems. All elevator and escalator shunt trip devices shall be installed per the ASME A17.1 Safety Code for Elevators and Escalators.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

E. Install filler plates in unused spaces.

F. Provide ONE additional panelboard and accessories of each size and type used on the project to accommodate changes required to resolve interferences or as directed by the Engineer.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.

C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match the original finish.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI or GFI: Ground-Fault Circuit Interrupter.

B. SPD: Surge Protection Device

C. TVSS: Transient Voltage Surge Suppressor.

1.4 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Legends for receptacles and switch plates.

C. Samples: For devices and device plates for color selection and evaluation of technical features.

D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
1. Floor Service-Outlet Assemblies: One for every 20, but not less than one.
2. Toggle switches with occupancy sensors: One for each five installed but not less than two.
3. TVSS Receptacles: One for each eight installed, but not less than two.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Wiring Devices:

a. Hubbell, Inc.; Wiring Devices Div.
b. Killark Electric Manufacturing Co.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand; Wiring Devices Div.

2. Wiring Devices for Hazardous (Classified) Locations:

a. Crouse-Hinds Electrical Co.; Distribution Equipment Div.
b. Killark Electric Manufacturing Co.
c. Pyle-National, Inc.; an Amphenol Co.

3. Multioutlet Assemblies:

a. Airey-Thompson Co.
b. Legrand/Wiremold Division.

2.2 RECEPTACLES

A. Straight-Blade (tamper resistant) and Locking Receptacles: Heavy-Duty grade.

B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.

C. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.

1. Devices: Listed and labeled as isolated-ground receptacles.
2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

D. TVSS Receptacles: Duplex type, NEMA WD 6, Configuration 5-20R, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; rated a nominal clamp level of 500 transient-suppression voltage and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.
2. Active TVSS Indication: Light visible in face of device to indicate device as "active" or "no longer active."
3. Identification: Distinctive marking on face of device denotes TVSS-type unit.

E. Industrial Heavy-Duty Receptacle: Comply with IEC 309-1.

F. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.3 PENDANT CORD/CONNECTOR DEVICES

A. Description: Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. 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.

2.4 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 CORD REELS

A. A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: GFCI type device, Nylon body. Match cord and receptacle type for connection
3. Reel: 15 Amp rated, 125V, with 25 linear feet of retractable cable (Hubbell model #HBL45123C). Provide mounting assembly as required for complete installation.

2.6 SWITCHES

A. Snap (toggle) Switches: Heavy-duty, quiet type (single, 3-way and 4-way).

1. Switch: 20 A, 120/277-V ac.

2. Switch with occupancy sensing: 20 A, 120/277-V ac. Passive infrared compaitable with LED and CFL lamps, adjustable time delay of 20 seconds to 30 minutes, 0 – 1000 watt lighting control, manual by-pass control.

3.1 WALL PLATES

A. Single and combination types match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.

3.2 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal, with manufacturer's standard finish.

C. Raceway Material: Nonmetal.(accepted in office areas only)

D. Wire: No. 12 AWG.

3.3 FLOOR BOXES FOR ON-GRADE AND ABOVE-GRADE CONCRETE FLOORS

1 Configurations: Boxes shall be available in one-, two-, or three-gang configurations or a single unit with two to eleven independent wiring compartments and available in stamped steel, epoxy coated stamped steel, nonmetallic and cast-iron versions. Boxes shall be available in deep and shallow versions. Boxes shall provide pre- and post-pour adjustments. Multiple gang boxes shall also provide a removable barrier between the individual compartments for greater capacity when required. Refer to Drawings for size and types.

a. Acceptable Product: Resource RFB4 Series Boxes for Concrete Floors by Legrand/Wiremold.

b. Acceptable Product: Resource RFB4E-OG Series Shallow Epoxy Coated Stamped Steel Floor Boxes for Concrete Floors by Legrand/Wiremold.

2 Cover:

a. Acceptable Product: FloorPort FPCT, FPBT, and FPFFT Series Covers: Manufactured of die-cast aluminum or die-cast zinc, and available in brushed aluminum finish and powder-coated paint finishes (black, gray, bronze, nickel and brass). Activation covers shall be available in flanged and flangeless versions. Covers shall be available with options for tile or carpet inserts, or flush covers. The cover's hinge shall allow for the cover to open 180 degrees. The furniture feed covers shall come equipped with one 1 inch (25 mm) trade size screw plug opening and one combination 1-1/4 inches (32 mm) and 2 inches (52 mm) trade size screw plug.

1) Flanged covers shall be 7-3/4 inches L by 6-9/16 inches W (197 mm by 167 mm).

2) Flangeless covers shall be 6-3/4 inches L by 5-9/16 inches W (171 mm by 142 mm).

3 Metallic Floor Boxes:

a. Material: Stamped steel and painted with a fusion-bonded epoxy; box interior and exterior painted; 1-3/8 inches (35 mm) pre-pour adjustment; 3/4 inch (19 mm) post-pour adjustment.

b. Material: Epoxy coated cast iron; box interior and exterior painted; 1-3/4 inches (44 mm) pre-pour adjustment; 1/2 inch (13 mm) post-pour adjustment.

c. Box Type: Rectangular.

d. Service: Multiple.

3.4 MISCELLANEUOS WIRING CONNECTIONS AND COMPONENTS

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal, with manufacturer's standard finish.

C. Raceway Material: Nonmetal. (accepted in office areas only)

D. Wire: not less than the manufacturer's recommendation unless noted otherwise.

E. Security Devices: Provide all wiring devices and connections as specified by the manufacturer and the contract documents. Unless otherwise noted.

F. IT Devices: Provide all wiring devices and connections as specified by the manufacturer and the contract documents. Unless otherwise noted.

G. Audio Visual Devices: Provide all wiring devices and connections as specified by the manufacturer and the contract documents Unless otherwise noted.

3.5 FINISHES

A. Color: Manufacturers standard, as selected by Architect.

PART 3 - EXECUTION

4.1 INSTALLATION

A. Install devices and assemblies' plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. All receptacles used for garage installations shall be GFIC type wiring devices.

E. Do not share neutral conductor on load side of dimmers.

F. Provide ten additional wiring devices (receptacles, TVSS, wallplates, switches, etc.) and accessories of each size and type used on the project to accommodate any changes required to resolve interfereces.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Protect devices and assemblies during painting.

I. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

4.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

B. Comply with Division 16 Section "Basic Electrical Materials and Methods."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with an approved legend engraved on wall plate.
2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

4.3 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

D. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

4.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Check TVSS receptacle indicating lights for normal indication.

C. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

D. Replace damaged or defective components.

4.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 262726

SECTION 262813 - 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. Motor-control centers.
c. Panelboards.
d. Switchboards.
e. Enclosed controllers.
f. Enclosed switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bussmann, by Eaton
2. Edison
3. Littlefuse, Inc.
4. Mersen USA
5. Mersen-Ferraz

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: 250-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type RK-5: 250-V, zero- to 600-A rating, 200 kAIC, time delay.

3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting.
4. Type CD: 600-V, 31- to 60-A rating, 200 kAIC, fast acting.
5. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
6. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
7. Type T: 600-V, zero- to 1200-A rating, 200 kAIC, very fast acting.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Owner.

3.2 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.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Service disconnecting means.
2. Feeder and branch-circuit protection.
3. Motor and equipment disconnecting means.

B. Related Sections include the following:

1. Division 262726 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
2. Division 262416 Section "Panelboards and Switchboards" for individually enclosed, fusible switches used as feeder protection.
3. Division 262813 Section "Fuses" for fusible devices.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. RMS: Root mean square.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each switch and circuit breaker.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Current and voltage ratings.
c. Short-circuit current rating.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.

D. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for components.
2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA AB 1 and NEMA KS 1.

D. Comply with NFPA 70.

E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

a. Potential Transformer Fuses-Provide an additional 6 fuses of each type utilized on this project.
b. Control-Power Fuses-Provide an additional 6 fuses of each type utilized on this project.
c. Fuses and Fusible Devices for Fused Circuit Breakers-Provide an additional 6 fuses of each type utilized on this project.
d. Fuses for Fused Switches-Provide an additional 10 fuses of each type utilized on this project.
e. Fuses for Fused Power-Circuit Devices-Provide an additional 10 fuses of each type utilized on this project.

2. Spare Indicating Lights-Provide an additional 6 lights of each type utilized on this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fusible Switches:

    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution & Control Division.
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

2. Molded-Case Circuit Breakers:

    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution & Control Division.
    c. Klockner-Moeller.
    d. Siemens Energy & Automation, Inc.
    e. Square D Co.

3. Combination Circuit Breaker and Ground-Fault Trip:

    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution & Control Division.
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

4. Molded-Case, Current-Limiting Circuit Breakers:

    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution & Control Division.
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

5. Integrally Fused, Molded-Case Circuit Breakers:

    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution & Control Division.
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

2.2 ENCLOSED SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, minimum 600V rated, with lockable handle.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, minimum 600V rated, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
7. Molded-Case Switch: Molded-case circuit breaker without trip units.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system.
5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
7. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b"contacts operate in reverse of circuit-breaker contacts.
8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.5 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosures before shipping.

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.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

B. Provide an additional four branch breakers with enclosures and accessories of each size, phase and voltage as required to accommodate changes to resolve interferences or as directed by the Engineer.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 260500 Section "Basic Electrical Materials and Methods"

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

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 and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.

C. 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. Open or remove doors or panels so connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches and circuit breakers checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 262816

SECTION 262923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

B. Related Requirements:

1. Section 262419 "Motor-Control Centers" for VFCs installed in motor-control centers.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. DDC: Direct digital control.

C. EMI: Electromagnetic interference.

D. OCPD: Overcurrent protective device.

E. PID: Control action, proportional plus integral plus derivative.

F. RFI: Radio-frequency interference.

G. VFC: Variable-frequency motor controller.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.

B. Shop Drawings: For each VFC indicated.

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Data, including but not limited to: NEMA enclosure rating, Data interface modules, SCADA interfacing and remote controlling capability, electronic liquid crystal display with touch screen manual programming and control functionality, bypass equipment details and compatibility.

B. Qualification Data: For testing agency.

C. Seismic Qualification Data: Certificates, for each VFC, accessories, and components, from manufacturer.

1. Certificate of compliance.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.

D. Product certificates.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Allen Bradley (Rockwell Automation) Basis of Design

B. Yaskawa

C. Square D (Schnieder Electric)

2.2 SYSTEM DESCRIPTION

A. General Requirements for VFCs:

1. The Basis of design is Allen Bradley (Rockwell Automation) PowerFlex Model 750 Series.

a. Rating: 100 Horse Power (minimum)
b. Voltage: 480Volt
c. Hz: 60
d. Phase: Three (3)

2. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

B. Application: variable torque.

C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1 motors.
2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

F. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 65 kA.
7. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F.
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet.
10. Vibration Withstand: Comply with NEMA ICS 61800-2.
11. Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
13. Speed Regulation: Plus or minus 5 percent.
14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

G. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.

I. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

J. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
6. Critical frequency rejection, with [three] <Insert number> selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor-overtemperature fault.

K. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

L. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

O. Integral Input Disconnecting Means and OCPD: UL 489, thermal-magnetic circuit breaker or NEMA KS 1, fusible switch with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
2. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
4. NC and NO alarm contact that operates only when circuit breaker has tripped.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least one level of access: View only; view and operate; and view, operate, and service.

    a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last ten faults with time and date stamp for each.

D. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).

6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:
   a. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:

   a. 0- to 10-V dc.
   b. 4- to 20-mA dc.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of three programmable analog output signal(s) (4 to 20-mA dc), which can be configured for any of the following:

   a. Output frequency (Hz).
   b. Output current (load).
   c. DC-link voltage (V dc).
   d. Motor torque (percent).
   e. Motor speed (rpm).
   f. Set point frequency (Hz).
   g. SCADA interface.

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Minimum Number of Loops: Two.

2.5 BYPASS SYSTEMS

A. Bypass Operation: Manually transfers motor between power converter output and bypass circuit. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Output Isolating Contactor: Non-load-break, NEMA-rated contactor.

3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

C. Bypass Contactor Configuration: Reduced-voltage (autotransformer) type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
    b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

5. Control Circuits: 120V ac; obtained from integral CPT, with primary and secondary fuses] with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: 100 VA.

6. Overload Relays: NEMA ICS 2.

2.6 OPTIONAL FEATURES

A. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

B. SCADA interface.

2.7 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R or Type 4X.
3. Kitchen and/or Wash-Down Areas: Type 4X, 316 stainless steel.
4. Other Wet or Damp Indoor Locations: Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.8 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons: Unguarded.
2. Pilot Lights: Push to test.
3. Selector Switches: Rotary type.

B. Reversible NC/NO bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

E. Supplemental Digital Meters:

1. Elapsed-time meter.
2. Kilowatt meter.
3. Kilowatt-hour meter.

F. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

H. Cooling Fan and Exhaust System: For NEMA 250, Type 12UL 508 component recognized: Supply fan, with stainless steel intake and exhaust grills and filters 120V ac; obtained from integral CPT.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Install fuses in each fusible-switch VFC.

C. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

D. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

F. Comply with NECA 1.

3.2 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

3.3 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer and Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. VFCs will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.5 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer and Owner before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges.

F. Set field-adjustable pressure switches.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

PART 4 - QUANTITY AND PAYMENT

A. No separate payment will be made for work performed under this section. All costs for work performed under this section shall be included in the prices bid for the various scheduled items in the Bid Form.

END OF SECTION 262923

SECTION 263213 – DIESEL POWERED GENERATOR

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

B. Rebranding and OEM (original equipment manufacturer) agreements: Only equipment manufactured by the listed OEM manufacturers will be acceptable. Units that are manufactured by others and rebranded will NOT be acceptable for this contract and will be rejected. Letters from OEM stating that re-branded units are “equal” shall be rejected.

C. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

D. The generator set manufacturer shall warrant all equipment provided under this section, whether or not it is manufactured by the generator set manufacturer, so that there is one source for warranty and product service.

E. This specification is not a performance specification. Any/all suggested manufacturer substitutions the contractor elects to submit to the engineer MUST be fully 100% equal to or better than that specified or the product will be rejected. This includes all equipment components such as but not limited to: dip ratios, horsepower, torque, capacity, cubic inch engine size, alternator, charger, coolant system, etc.

F.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. This Section includes packaged engine-generator sets suitable for use in mission critical applications with the features as specified and indicated. Engine generators will be used as the Standby power source for the system, but shall be capable of providing reliable power with no run-time limitations while the primary source of power is unavailable.

1.4 DEFINITIONS

A. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions

for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.

B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

3. Sound test data, based on a free field requirement.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Wiring Diagrams: Control interconnection, Customer connections.

C. Sizing Report

1. Calculated performance based on loads shown on one line

D. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.

1.6 INFORMATIONAL SUBMITTALS

A. Source quality-control test reports.

1. Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.

2. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.

3. List of factory tests to be performed on units to be shipped for this Project.

4. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.

B. Warranty:

1. Submit manufacturer’s warranty statement to be provided for this Project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 2 hours of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Comply with NFPA 37 (Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines).

E. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).

F. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 0.0 deg C (32.0 deg F) to 40.0 deg C (104.0 deg F).

2. Relative Humidity: 0 to 95 percent.

3. Altitude: Sea level to 200.0 feet (60.96 m).

1.9 WARRANTY

A. Extended Warranty: Manufacturer shall offer extended coverage of 5 years from date of registered commissioning and start-up. Warranty shall be comprehensive.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Only approved manufacturers shall supply equipment provided under this contract. Equipment specifications for this project are based on generator sets manufactured by Cummins Power Generation with microprocessor-based controls.

B. Proposals for substitutions must include a line by line compliance statement based on this specification in a hard copy formal written submission provided only by the 'bidding contractor' (those that have purchased the contract documents). Note: This does not ensure the approval of the product. No manufacturer sales representatives requesting approval will be reviewed.

Other acceptable manufacturers listed below will be considered however must comply with the specification in its entirety (no exception).

a. Cummins Power (Onan) Basis of Design

2.2 ENGINE-GENERATOR SET

A. Provide Cummins model DFEK factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

C. Capacities and Characteristics:

1. Power Output Ratings: Electrical output power rating for Standby operation of not less than 500.0kW, at 80 percent lagging power factor, 277/480V, Three phase, 4 -wire, 60 hertz.

2. Alternator shall be capable of accepting maximum 2429 kVA in a single step and be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set.

3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.

2. Transient Voltage Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 1.2 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.

3. Steady-State Frequency Operational Bandwidth: 0.25 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 3.4 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.

6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.

8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.

9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.3 ENGINE

A. Provide Cummins model QSX15 – G9 in line 6 cylinder

B. Minimum displacement of 912CU

C. Minimum BHP of 755

D. Fuel: ASTM D975 #2 Diesel Fuel

E. Rated Engine Speed: 1800RPM.

F. Lubrication System: The following items are mounted on engine or skid:

1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.

2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

G. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions

H. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.

I. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

1. Designed for operation on a single 208/240/480 VAC, 4990W Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.

2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.

3. Provided with a 24VDC thermostat, installed at the engine thermostat housing

J. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.

K. Cooling System: Closed loop, liquid cooled

1. Provide a 50C ambient design set mounted radiator cooling system

2. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40 deg C.

3. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

4. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

5. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

6. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

L. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator

sets with outdoor enclosures the silencer shall be inside the enclosure. Exhaust noise shall be included in the enclosure sound data report

M. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.

N. Starting System: 24V as recommended by the engine manufacturer; electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.

2. Cranking Cycle: As required by NFPA 110 for level 1 systems.

3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.

4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.

5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.

6. Battery Chargers: Unit shall comply with UL 1236, 12A 24VDC provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:

a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.

f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Sub Base-Mounted Fuel Oil Tank: Provide a double wall secondary containment type sub base fuel storage tank. The tank shall be constructed of corrosion resistant steel and shall be UL 142 listed and labeled. The fuel tank shall include the following features:

1. Capacity: Provide a minimum 2525G usable fuel for 72 Hour(s) continuous operation at 100 percent rated power output.

2. Tank rails and lifting eyes shall be rated for the full dry weight of the tank, genset, and enclosure.

3. Electrical stub up(s)

4. Normal & emergency vents

5. Lockable fuel fill

6. Mechanical fuel level gauge

7. Low level switches to indicate fuel level

8. Leak detector switch

9. Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.

10. Tank design shall meet the regional requirements for the Project location

2.5 CONTROL AND MONITORING

A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but

equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter (3-phase, line to line and line to neutral values).
2. AC ammeter (3-phases).
3. AC frequency meter.
4. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
5. Emergency Stop Switch: Switch shall be a red “mushroom head” pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
6. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
7. DC voltmeter (alternator battery charging).
8. Engine-coolant temperature gauge.
9. Engine lubricating-oil pressure gauge.
10. Running-time meter.
11. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.) The voltage and frequency adjustment functions shall be disabled when the paralleling breaker is closed.

12. Fuel tank derangement alarm.

13. Fuel tank high-level shutdown of fuel supply alarm (if applicable).

14. AC Protective Equipment: The control system shall include over/under voltage, reverse kVAR over current, loss of voltage reference, and over excitation shut down protection. There shall be a overload warning, and overcurrent warning alarm.

15. Status LED indicating lamps to indicate remote start signal present at the control, existing shutdown condition, existing alarm condition, not in auto, and generator set running.

16. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

17. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.

18. Data Logging: The control system shall log the latest 20 different alarm and shut down conditions, the total number of times each alarm or shutdown has occurred, and the date and time the latest of these shutdown and fault conditions occurred.

19. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage re-cover on loading (engine cranking).

20. Control anti condensation strip heater

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Temperature Rise: 125 / Class H environment.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip-proof.

H. Voltage Regulator: SCR type, Separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.

I. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

J. Subtransient Reactance: 12 percent maximum, based on the rating of the engine generator set.

K. Alternator strip heater

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound Attenuated housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:

1. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.

2. Exhaust System:

a. Muffler Location: Within enclosure.

3. Hardware: All hardware and hinges shall be stainless steel.

4. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.

5. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.

1. Louvers: motorized cooling-air inlet.

2. Louvers: Fixed-engine, cooling-air discharge.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 73 dBA average measured at any location 7 m from the engine generator in a free field environment.

E. Electrical package: Provide single phase house panel with MCB rated to power enclosure and generator set mounted accessories called out in this specification. Panel shall provide branch circuits prewired to the engine block heater, alternator heater, control heater, auto motorized louvers, battery charger and convenience receptacles as required by application.

F. Site Provisions:

1. Lifting: Complete assembly of engine generator, enclosure, and sub base fuel tank (when used) shall be designed to be lifted into place as a single unit, using spreader bars.

2.8 VIBRATION ISOLATION DEVICES

A. Vibration Isolation: Generators installed on grade shall be provided with elastomeric isolator pads integral to the generator, unless the engine manufacturer requires use of spring isolation.

2.9 FINISHES

A. Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer’s standard color or as directed on the drawings.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.

2. Full load run.

3. Maximum power.

4. Voltage regulation.

5. Steady-state governing.

6. Single-step load pickup.

7. Simulated safety shutdowns.

8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

9. Provide fuel transfer testing for operations with use of the existing remote fuel tank.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.

B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer’s recommended practice.

3.2 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:

B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.

C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.4 SERVICE AND SUPPORT

A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The inventory shall have a commercial value of $3 million or more. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 2 hours of the site.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

PART 1 - QUANTITY AND PAYMENT

A. Payment for this item shall be included in the lump sum cost under the line item “AUXILIARY POWER GENERATOR SET AND ASSOCIATED EQUIPMENT, COMPLETE” as listed in the bid form. Such cost shall include but not limited to furnishment and installation of equipment and material as required per the contract documents and all other work in connection therewith or incidental thereto.

END OF SECTION

SECTION 263600 - SERIES 300 SERVICE ENTRANCE RATED AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.01 Scope

A. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

B. Furnish an enclosure for the (3AUS) that is for service entrance. It shall provide all of the proper disconnecting, protection, grounding and bonding required for service entrance equipment.

1.02 Acceptable Manufacturers

Service entrance automatic transfer switches shall be ASCO Series 3AUS. Any alternate shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.03 Codes and Standards

The service entrance automatic transfer switch and accessories shall conform to the requirements of:

A. UL 1008 Listed for Optional Standby Transfer Switches (Manual Transfer Switches)

B. CSA C22.2 No.178 1978

C. IEC 60947-6-1 Low – Voltage Switchgear and Controller

D. NFPA 70 - National Electrical Code

E. NFPA 99 – Essential Electrical Systems for Health Care Facilities

F. IEEE Standard 446 - IEEE Recommended Practice for Emergency and StandbyPower Systems for Commercial and Industrial Applications

G. UL 508 Industrial Control Equipment

H. UL 891 Switchboards

I. NEC Articles 700, 701, 702

J. International Standards Organization ISO 90estrication 01: 2008

K. RoHs compliant (Restriction of Hazardous Substances)

L Seismic qualification – International Building Code & OSHPD to SDS level of 2.5

PART 2 PRODUCTS

2.01 Mechanically Held Transfer Switch

C. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

D. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

E. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

F. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

G. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

H. Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.

I. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.02 Group G Controller with Integrated User Interface Panel

A. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built – in microprocessor for maximum reliability, minimum maintenance, inherent serial communications capability, and the ability to communicate via Ethernet through optional communications module.

C. A single controller shall provide single and three phase capability for maximum application flexibility and mimimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.1 Hz. Time delay settings shall be accurate to ± 0.5% of the full scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C, and storage from -55 to + 85 degrees C.

D. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Senisng and control logic shall be provided on printed circuit boards.

E. The controller shall meet or exceed the requirements for Electromagnetic Compability (EMC) as follows:

1. IEC 60947-6-1 Multiple Function Equipment Transfer Switching Equipment. 61000-4 Testing And Measurement Techniques – Overview

a. IEC 61000 – 4 – 2 Electrostatic Discharge Immunity

b. IEC 61000 - 4 – 3 Radiated RF Field Immunity

c. IEC 61000 – 4 – 4 Electrical Fast Transient/Burst Immunity

d. IEC 61000 – 4 – 5 Surge Immunity

e. IEC 61000 – 4 – 6 Conducted RF Immunity

2. CISPR 11 – Conducted RF Emissions and Radiated RF Emiissions

2.03 Enclosure

A. The service entrance 3AUS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

B. Controller shall be mounted on, visable, and operational through enclosure door..

C. The complete assembly shall be degreased, and thoroughly cleaned through a five-stage aqueous process. The finish shall be ANSI-61, light gray, electrostatically-charged polyester powder paint over a phosphate coating, at a minimum of 2.0 mils in density. Finish shall be suitable for indoor and outdoor environments.

D. For those automatic transfer switches that are less than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size cable. For those automatic transfer switches that are greater than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size bus. Bus shall be silver plated copper rated no less than 1000 amps per square inch.

E. A pressure disconnect link shall be provided to disconnect the normal source neutral connection from the emergency and load neutral connections for 4-wire applications. A ground bus shall be provided for connection of the grounding conductor to the grounding electrode. A pressure disconnect link for the neutral to ground bonding jumper shall be provided to connect the normal neutral connection to the ground bus.

F. Control wiring shall be rated for 600 volt, UL 1015. Wires shall be placed in wire duct or harnessed, and shall be supported to prevent sagging or breakage from weight or vibration. All wiring to hinged doors shall be run through door terminal blocks or connection plugs.

PART 3 OPERATIONS

3.01 Controller Display and Keypad

A. A 128*64 graphical LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters.
Operational parameters shall also be available for viewing and limited control through communications port. The following parameters shall only be adjustable via DIP switches on the controller.

1. Nominal line voltage and frequency

2. Single or three phase sensing on normal

3. Transfer operating mode configuration, (open transition, or delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

3.02 Voltage and Frequency Sensing

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup,dropout, and trip settings capabilities (values shown as % of nominal unless otherwise specified.

Parameter	Sources	Dropout/Trip	Pickup/Reset
Undervoltage	N & E	70 to 98%	85 to 100%
Overvoltage	N & E	102 to116%	2% below trip
Underfrequency	N & E	85 to 98%	86 to 100%
Overfrequency	N & E	101 to 111%	2% bellow trip

B. Repetitive accuracy of all settings shall be within 1% at +25C

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency. *Note: Single phase sensing on emergency*

E. The backlit 128*64 graphical display shall have multiple language capability.
Languages can be selected from the user interface.

3.03 Time Delays

A. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds. It shall be possible to bypass the time delay from the controller user interface.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes 59 seconds for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.

C. A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 or 4 seconds.

D. A time delay shall be provided on retransfer to normal, adjustable 0 to 9 hours 59 minutes 59 seconds. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

E. A cooldown time delay shall be provided on shutdown of engine generator, Adjustable 0 to 60 minutes 59 seconds.

F. All adjustable time delays shall be field adjustable without the use of special tools.

G. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minutes 59 seconds time delay in any of the following modes:

1. Prior to transfer only.

2. Prior to and after transfer.

3. Normal to emergency only.

4. Emergency to normal only.

5. Normal to emergency and emergency to normal.

6. All transfer conditions or only when both sources are available.

H. In the event that the alternate source is not accepted within the configured Failure to Accept time delay, the common alert indication shall become active.

I. The controller shall also include the following built-in time delay for delayed transition operation.

1. A time delay for the load disconnect position for delayed transition operation adjustable 0 to 5 minutes 59 seconds.

3.04 Additional Features

A. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down. setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed when the ATS is connected to the emergency source.

D. A single alarm indication shall light up the alert indicator and de – energize the configured common alarm output relay for external monitoring.

E. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

F. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency (red) source, as determined by the voltage sensing trip and reset settings for each source.

G. LED indicating light shall be provided to indicate switch not in automatic mode (manual); and blinking (amber) to indicate transfer inhibit.

H. LED indicating light shall be provided to indicate any alarm condition or active time delay (red).

I. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

J. A variable window inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO feature 27.

K. An engine generator exercising timer shall be provided to configure weekly and bi-weekly automatic testing of an engine generator set with or without load for 20 minutes fixed. It shall be capable of being configured to indicate a day of the week, and time weekly testing should occur.

L. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency. This inhibit signal can be enabled through the keypad or serial port.

M. System Status - The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key. This screen shall display a clear description of the active operating sequences and switch position. For example,

Normal Failed
Load on Normal
TD Normal to Emerg
2min15s

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual are not permissible.

N. Self Diagnostics – The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input

signals to the controller which may be preventing load transfer commands from being completed.

O. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication port with a network of transfer switches, locally (up to 4000 ft.). Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control, and setup of parameters.

P. Data Logging – The controller shall have the ability to log data and to maintain the last 300 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non – volatile memory.

1. Event Logging

    1. Data and time and reason for transfer normal to emergency
    2. Data and time and reason for transfer emergency to normal
    3. Data and time and reason for engine start
    4. Data and time engine stopped
    5. Data and time emergency source available
    6. Data and time emergency source not available

2. Statistical Data

    1. Total number of transfers
    2. Total number of transfers due to source failure
    3. Total number of day's controller is energized
    4. Total number of hours both normal and emergency sources are Available
    5. Total time load is connected to normal
    6. Total time load is connected to emergency
    7. Last engine start
    8. Last engine start up time
    9. Input and output status

4.01 Optional Features

A. Accessory Package - An accessory bundle shall be provided that includes:

1. A fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without load on a daily weekly, bi – weekly, or monthly basis.

2. Event log display that shows event number, time and date of events, event type, and reason (if applicable). A minimum of 300 events shall be stored.

3. RS – 485 communications port enabled.

4. Common alarm output contact.

5.01 ATS Remote Annunciator

General

Provide and install ATS Remote Annunciators for monitoring and control of automatic transfer switches remotely over Ethernet.

A. Hardware Specifications

The ATS Remote Annunciator shall be listed to cUL-60950-1 and UL 1008 and include the following features and ratings*:*

- *User-configured labels with ATS names and power sources*
- *Dual 10/100 Base-T auto sensing and auto crossover Ethernet ports*
- *LED indication of source acceptability, switch position, common alarm, time delay and Ethernet link activity*
- *Push button for transfer/retransfer control operations and time delay bypass*
- *Push buttons for Alarm Silence and Lamp Test*
- *Key lock to enable and disable the transfer push button*
- *Audible and visual alarm to indicate Communication Error ATS Locked Out Failure to Synchronize Extended Parallel and any of the 8 user-configured discrete inputs*
- *Programmable watchdog timer that can generate a system reset upon timeout (minimum 1 sec)*
- *Factory reset capability*
- *100 ms power ride-through*

B. Software Specification

The ATS Remote Annunciator shall contain embedded web pages accessible via various web browsers with the following capabilities:

- *Configuration for protocol and communications management with the ability of auto discovering transfer switches on network*
- *Ability to create and print customized labels for ATS names and power sources*
- *The ability to choose a continuous or periodic audible alarm with customizable interval time*
- *View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters*
- *ATS source name configuration page which allows users to configure power source names and print labels*
- *Upgrade firmware from Ethernet network without interrupting equipment operation*

C. Communications

Dual 10/100 Base-T (RJ-45) Ethernet ports are provided to support TCP/IP communications for up to eight automatic transfer switches via individual remote connectivity modules or daisy-chained serial modules into a single Connectivity Module. Additional features include:

- *Supports Full Duplex Flow Control (IEEE 802.3x)*
- *3.3V power supply with 5V I/O tolerance*
- *Supports 3 LEDs to indicate traffic link speed and collision*

D. Mounting

The ATS Remote Annunciator is suitable for:

- *Surface mounting using mounting screws studs*
- *Flush Mount from behind a cutout section (Enclosure Door Mounting)*
- *Flush Mount from the front of a cutout section (Enclosure Door Mounting)*

E. Power Supply

The ATS Remote Annunciator shall be capable of accepting 24VDC, 120 VAC or 240 VAC power source.

F. Environmental

The ATS Remote Annunciator shall have an Ambient Operating Temperature range of -4 º to 158 º F (-20 º to +70 º C) @ 5~85% humidity and Ambient Storage Temperature of -40 º to 185 º F (-40 º to 85 º C).

5.02 Disconnecting and Overcurrent Protection Device

A. For those automatic transfer switches less than 1000 amperes, the normal connection shall be provided with a thermal magnetic rated molded case circuit breaker with current ratings as shown on the plans. It shall have a thermal magnetic trip unit.

G. For those automatic transfer switches rated above 1000 amperes, the normal connection shall be provided with a stationary mount, insulated case circuit breaker with a solid-state trip unit. The trip unit shall have an adjustable long time, short time, instantaneous, and ground fault trip settings. The insulated case circuit breaker shall trip open when the ground fault setting is exceeded.

ADDITIONAL REQUIREMENTS

6.01 Ampere Interrupting Capacity (AIC)

A. The maximum short circuit current the breaker shall be required to interrupt is as follows:

Switch Rating	AIC Rating	Voltage
70 - 225	25,000A	480V
250, 400	50,000A	480V
600	50,000A	480V
800 – 2000	65,000A	480V
2500, 3000	100,000A	480V

6.02 Tests and Certification

A. The complete 3AUS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001:2008.

6.03 Service Representation

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

C. For ease of maintenance and parts replacement, the switch nameplate shall include drawing numbers, part numbers for main coil and control.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for work performed under this section. All costs for work performed under this section shall be included in the prices bid for the various scheduled items in the Bid Form.

END OF SECTION

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.1. SUMMARY

A. Section Includes: Traditional lightning protection system installation requirements for
   1. Ordinary structures.

B. Related Requirements
   1. 260526 Grounding and Bonding for Electrical Systems

1.2. REFERENCES

A. Abbreviations And Acronyms
   1. LPS Lightning Protection System.
   2. LPI Lightning Protection Institute.
   3. LPI-IP Lightning Protection Institute's Inspection Program an independent third party inspection program administrated by LPI and inspected by Intertek, an internationally known testing and inspection agency

B. Definitions: Terms shall be as defined in the referenced standards.

C. Reference Standards
   1. NFPA 780 Standard for the Installation of Lightning Protection Systems
   2. UL 96 Lightning Protection Components
   3. UL 96A Installation Requirements for Lightning Protection Systems
   4. LPI-175 Standard of Practice for the Design-Installation-Inspection of Lighting Protection Systems

1.3. ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate installation of exposed rooftop conductors with roof and parapet surfaces.
   2. Coordinate installation of down conductors with exterior surfaces.

1.4. ACTION SUBMITTALS

A. Product Data: Manufacturer's catalog data for the following items:
   1. Air terminals.
   2. Main and secondary conductors.
   3. Clamp-type connectors.
   4. Lightning protection components.

B. Shop Drawings: Overall lightning protection system, including
   1. Physical layout of the equipment.
   2. Dimensions (if not equal spacing).
   3. Atypical mounting details.
   4. Relationship to other parts of the Work.

C. Qualification Statements
   1. Manufacturer's qualifications.
   2. Installer's qualifications.
   3. Installer's LPS design qualifications.
      a. LPI Master Installer/Designer Certification

1.5. CLOSEOUT SUBMITTALS
   A. Operation And Maintenance Data
   B. Record Documentation
   C. Certificates
   D. As-Built Drawings

1.6. QUALITY ASSURANCE

   A. Qualifications
      1. Manufacturers
         a. Regularly engaged in the production of lightning protection equipment complying with UL 96.
         b. Member of the Lightning Protection Institute (LPI).
      2. Installers
         a. Company shall be listed by UL as a Lightning Protection Installer for a minimum of five (5) years.
         b. System installation shall be performed under the supervision of an onsite LPI Certified Master Installer.

   B. Certifications: LPI-IP Master Installation Certificate for LPS on the entire structure OR LPI-IP Limited Scope Inspection – limited to the LPS within the roof area(s) that are within the scope of work for this project.

PART 2 PRODUCTS

2.1. LIGHTNING PROTECTION COMPONENTS

   A. Manufacturers
      1. Manufacturer List
         a. East Coast Lightning Equipment, Inc. (www.ecle.biz)
         b. Warren Lightning Rod Company (www.wlrc.net) P: 856-854-7000 (BASIS of DESIGN)

   B. Substitution Limitations: Or equal products may be used.
      1. Must meet and / or exceed the proposed design and specifications.
      2. Any substitution (installer/materials) generated shall be provided and responsible for all mechanical, electrical, architectural and structural modifications at no additional cost to owner.

   C. Materials
      1. Comply with UL 96.

2.2. LIGHTNING PROTECTION SYSTEM

   A. Design Criteria
      1. Design the lightning protection system in accordance with NFPA 780 and UL 96A.
         a. Air terminals shall extend a minimum of 10 inches (254 mm) above elements being protected.

b. Zone of Protection shall be determined using a 150 foot (46 m) radius rolling sphere.

2.3. ACCESSORIES

A. Fasteners: Suitable configuration for the intended application and of the same material as the conductor. Nails, screws, or bolts employed to secure the fasteners shall be of the same material as the fasteners or of material which is as resistant to corrosion as that of the fasteners. Galvanized or plated steel nails, screws, or bolts are not acceptable.
   1. Do not use mechanical fasteners on membrane roofing.

B. Adhesives: Compatible with both materials being adhered and approved by the manufacturer of any warranted material such as membrane roofing.

C. Connections and Splices: suitable configuration and type for the intended application and of the same material as the conductor.

PART 3 EXECUTION

3.1. INSTALLERS

A. Installer List
   1. Warren Lightning Rod Company. P: 856-854-7000 (BASIS of DESIGN)

B. Substitution Limitations: Or equal may be used.
   1. Must meet and / or exceed the proposed design and specifications.
   2. Must be state of NJ certified installer of Lightning Protection equipment and materials for a minimum of five (5) years.
   3. Any substitution (installer/materials) generated shall be provided and responsible for all mechanical, electrical, architectural and structural modifications at no additional cost to owner.

3.2. INSTALLATION

A. Comply with UL 96A and LPI-175.

B. Comply with approved shop drawings.

C. Comply with manufacturer’s installation recommendations.

3.3. WATERPROOFING THROUGH-ROOF PENETRATIONS

A. The roofing contractor shall furnish and install any slip-sheets, adhesives, etc. that may be required by the roofing manufacturer.

3.4. FIELD QUALITY CONTROL

A. Field Inspections: Obtain an LPI-IP lightning protection system inspection.

B. Non-Conforming Work: Repair any non-confirming conditions, excluding surge protection devices, and re-inspect until the Work passes at no additional cost to Owner.

PART 4 - QUANTITY AND PAYMENT

4.1 Payment for this item shall be included in the lump sum cost under the line item “PROVIDE AND INSTALL BUILDING LIGHTNING PROTECTION, COMPLETE” as listed in the bid form. Such cost shall include but not limited to furnishment and installation of equipment and material as required per the contract documents and all other work in connection therewith or incidental thereto.

END OF SECTION

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Electrification Products.
2. Eaton.
3. Leviton Manufacturing Co., Inc.
4. Liebert; a brand of Vertiv.
5. Schneider Electric USA, Inc.
6. Siemens Industry, Inc., Energy Management Division.

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 480 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

E. SCCR: Equal or exceed 200 kA.

F. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Electrification Products.
2. Eaton.
3. Leviton Manufacturing Co., Inc.

4. Schneider Electric USA, Inc.
5. Siemens Industry, Inc., Energy Management Division.

B. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Neutral to Ground: 1200 V for 480Y/277 V.
4. Line to Line: 2000 V for 480Y/277 V

E. SCCR: Equal or exceed 100 kA.

F. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Outdoor Enclosures: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain SPDs.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 264313

SECTION 265100 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of LED luminaires:

1. Cylinder.
2. Downlight.
3. Lowbay.
4. Recessed linear.
5. Strip light.
6. Surface mount, linear.
7. Surface mount, nonlinear.
8. Suspended, linear.
9. Suspended, nonlinear.
10. Materials.
11. Finishes.
12. Luminaire support.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Provide point by point photometric design comparison for all areas.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:

B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

C. Product Certificates: For each type of luminaire.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five (5) years (including parts, labor and materials) from date of Substantial Completion.

PART 2 - PRODUCTS

1. See Electrical Drawings for detailed lighting fixture schedule.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified[and the luminaire will be fully operational during and after the seismic event]."

2.3 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. Standards:

1. ENERGY STAR certified.
2. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
3. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
4. UL Listing: Listed for damp location.
5. Recessed luminaires shall comply with NEMA LE 4.

C. CRI of minimum 70. CCT of 4000 K for exterior pole lights. 3500K for all interior lights, unless noted otherwise on the lighting fixture schedule.

D. Rated lamp life of 50,000 hours to L70.

E. Light fixtures shall have the ability to be dimmable minimum 0-10V.

F. Lamps dimmable from 100 percent to 0 percent of maximum light output.

G. Internal driver.

H. Nominal Operating Voltage: 120 V ac, 277 V ac (Universal) See drawings for specific application voltage.

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

I. Housings:

1. Die-cast aluminum unless specified otherwise.

2.4 CYLINDER

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Include mounting bracket and/or assembly as required per the manufacturer’s recommendations.

2.5 DOWNLIGHT

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Universal mounting bracket.

C. Integral junction box with conduit fittings.

D. Optics: As

2.6 LOWBAY

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Universal mounting bracket.

2.7 RECESSED LINEAR

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Integral junction box with conduit fittings.

2.8 STRIP LIGHT

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Integral junction box with conduit fittings.

2.9 SURFACE MOUNT, LINEAR

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Integral junction box with conduit fittings.

2.10 SURFACE MOUNT, NONLINEAR

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Integral junction box with conduit fittings.

2.11 SUSPENDED, LINEAR

A. See Electrical Drawings for detailed lighting fixture schedule.

2.12 SUSPENDED, NONLINEAR

A. See Electrical Drawings for detailed lighting fixture schedule.

B. Integral junction box with conduit fittings.

2.13 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 re-lamping 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:

D. See Electrical Drawings for detailed lighting fixture information.
1. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Housings:

1. Die-cast-aluminum housing and heat sink, unless otherwise noted.

2.14 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 assembled or installed to minimize contrast.

2.15 LUMINAIRE SUPPORT

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 (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Rod Hangers: 3/8-inch minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Flush-Mounted Luminaire Support: Secured to outlet box.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or attached to a minimum 20 gauge backing plate or attached to wall structural members or attached using through bolts and backing plates on either side of wall unless specified otherwise.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with pendant mounted all-thread.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), 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 tubing or rod 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. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 265100

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. UTP cabling.
2. 62.5/125-micrometer, multimode optical fiber cabling.
3. Coaxial cabling.
4. RS-232 cabling.
5. RS-485 cabling.
6. Low-voltage control cabling.
7. Control-circuit conductors.
8. Fire alarm wire and cable.
9. Identification products.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

E. RCDD: Registered Communications Distribution Designer.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Pathways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

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

B. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For pathways, accessories, and components, from manufacturer.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC

system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube & Conduit; a business unit of Tyco Electrical & Metal Products.
   b. Cablofil.
   c. Cooper B-Line, Inc.
   d. GS Metals Corp.
   e. Snaketray; Cable Management Solutions, Inc.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. AMP Netconnect; a brand of Tyco Electronics Corporation.
3. Belden CDT Networking Division/NORDX.
4. Belden Inc.
5. Berk-Tek; a Nexans company.
6. CommScope, Inc.

7. Draka Cableteq USA.
8. Genesis Cable Products; Honeywell International, Inc.
9. Mohawk; a division of Belden.
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope, Inc. brand.
12. 3M; Communication Markets Division.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG or CMP.
    b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR; or CMP, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX; or CMP,.
    e. Multipurpose: Type MP or MPG; or MPP or MPR.
    f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, all hardware must be 100% compatible with cable type and transmission equipment:

1. ADC.
2. American Technology Systems Industries, Inc.
3. AMP Netconnect; a brand of Tyco Electronics Corporation.
4. Belden CDT Networking Division/NORDX.
5. Dynacom Corporation.
6. Hubbell Incorporated; Hubbell Premise Wiring.
7. Leviton Voice & Data Division.
8. Molex Premise Networks; a division of Molex, Inc.
9. PANDUIT CORP.
10. Siemon.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 5e or 66-style for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements:

1. AMP Netconnect; a brand of Tyco Electronics Corporation.
2. Belden CDT Networking Division/NORDX.
3. Berk-Tek; a Nexans company.
4. CommScope, Inc.
5. Corning Incorporated; Corning Cable Systems.
6. CSI Technologies Inc.
7. General Cable Technologies Corporation.
8. Mohawk; a division of Belden.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M; Communication Markets Division.

B. Description: Multimode, 50/125 or 62.5/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA-492AAAB or TIA-492AAAA-A for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

    a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.

5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable, Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Belden CDT Networking Division/NORDX.
4. Berk-Tek; a Nexans company.
5. Corning Incorporated; Corning Cable Systems.
6. CSI Technologies Inc.
7. Dynacom Corporation.
8. Hubbell Incorporated; Hubbell Premise Wiring.
9. Molex Premise Networks; a division of Molex, Inc.
10. Siemon.

B. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermate ability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type SC, Type ST, Type LC, Type MT-RJ connectors. Insertion loss not more than 0.75 dB.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Belden CDT Networking Division/NORDX.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka Cableteq USA.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

E. NFPA and UL Compliance: CATV Cable, Type CATV, or CATVP or CATVR shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles.

2.8 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Emerson Network Power Connectivity Solutions; AIM Electronics brand.
2. Leviton Voice & Data Division.
3. Siemon.

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. 1 pair, twisted, No. 16 AWG, stranded (19x29) No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.13 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (IMPORTANT: ALL FIRE ALARM CABLE SHALL BE PLENUM RATED CABLE: - NO EXCEPTION)

1. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire; a brand of Belden Inc.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.14 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. PANDUIT CORP.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.15 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-B.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems." for installation of supports for pathways, conductors and cables.

3.3 WIRING METHOD

A. Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 5e rating of components and that ensure Category 5e performance of completed and linked signal paths, end to end.

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

E. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

F. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

G. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.6 POWER AND CONTROL-CIRCUIT CONDUCTORS

A. 120-V Power Wiring: Install according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.7 CONNECTIONS

A. Comply with requirements in Division 28 Section "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.

D. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.

E. Comply with requirements in Division 28 Section "PLC Electronic Detention Monitoring and Control Systems" for connecting, terminating, and identifying wires and cables.

F. Comply with requirements in Division 28 Section "Digital Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

G. Comply with requirements in Division 28 Section "Refrigerant Detection and Alarm" for connecting, terminating, and identifying wires and cables.

3.8 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.9 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.10 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

b. Link End-to-End Attenuation Tests:

1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.

2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

5. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 280513

SECTION 283111 - ADDRESSABLE FIRE ALARM SYSTEM, NON-VOICE NOTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered by this Section shall include all labor, equipment, materials, and services to furnish and install a complete fire alarm system. It shall include all necessary hardware, software and licenses specifically tailored for this installation to form a complete coordinated system ready for operation. All equipment and materials furnished shall be of types or models approved for use in systems and occupancies of this type in accordance with the required codes. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.

The system shall be a new addressable fire detection and horn/ strobe notification system in accordance with the design drawings in full compliance with all applicable codes and standards. It shall utilize a main control panel with additional remote panels and notification booster panels, as required by the equipment manufacture. The system architecture shall support future modification and supply the minimum space capacities listed in this specification.

a. The system shall provide a commercial dual path communicator for off-site status signaling to a Central or Remove Receiving Station.
b. The system shall support the capability to monitor activity and remotely view information from a PC or app for NFPA 72 Auxiliary notification.
c. The system provided shall have the capacity and expansion capability to support future tenant improvement fit-outs, in compliance with relevant codes and modify the fire alarm based on the improved layout and specific occupancy type prior to any fit-out construction.
d. The system shall be supplied per the Engineer of Record's design drawings, project specifications and installed in full compliance with the project's cited editions of the National, State and local Codes. All work shall be approved by the local authority having jurisdiction (AHJ) and shall be installed, tested and documented in accordance with the requirements of NFPA 72. If there is a conflict between the referenced NFPA standards, federal, state or local codes, and this specification, it shall be the Installer's responsibility to immediately bring the conflict to the attention of the Owner's Consultant for resolution. The Installer shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the Owner. The following reference standards shall be used in conjunction with these requirements unless the applicable legally referenced documents provide more stringent requirements:
    1) Underwriters Laboratories (UL) Listings.
    2) Americans with Disabilities Act (ADA), the Architectural Barriers Act (ABA), and Accessibility Regulations of the local jurisdiction.
    3) Applicable FM Global (Factory Mutual) Property Loss Data sheets.
e. The Installer shall be responsible for filing all documents, paying all fees, securing all permits, inspections and approvals necessary for conducting this work. This included supplying any 3rd party reviews or certifications required by the AHJ.

2. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the schematic design drawings, whether or not specifically itemized herein. All devices installed outdoors or within areas exposed to unconditioned spaces or wet locations shall be listed for “outdoor use”. Electrical raceway, fittings and enclosures shall be NEMA Type 4.

3. All equipment furnished shall be new and the latest state-of-the-art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over 20 years.

4. Provide the services of qualified system designers to generate shop drawings, and field technicians to provide installation oversight during construction and system startup. Technicians shall inspect, program, test and make any necessary adjustments to the completed system, to ensure compliance with the manufacturer's recommended practices and the approved shop drawings.

5. The system as specified shall be supplied, installed, tested and receive approval by the local Authority Having Jurisdiction, to be turned over to the owner in an operational condition.

6. In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests. All control panel assemblies and connected field appliances shall be provided by the same system supplier and shall be designed and tested to ensure that the system operates as specified.

7. The system specified shall be that of Siemens Industry, model Desigo Modular which meets the project requirements. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications. All references to manufacturers model numbers and other pertinent information herein is intended to establish minimum standards of performance, function, and quality. Alternate products must be submitted to the Engineer two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification. All system approved shall meet all the requirements spelled out in this specification. System approval shall be in writing by the Engineer and a copy shall be submitted with the system submittals.

8. An Emergency Responder Radio Communications System (ERRCS), also known as a Public Safety/ First Responder Distributed Antenna System/ Auxiliary Radio Communication ARC System/ Public Safety Signal Booster, may be required per site conditions to boost weak emergency responder radio signals. The exact ERRCS system requirements shall be determined as required per a radio strength site survey and enforcement oby the local AHJ. Certain building elements are known to reduce radio signal strength, including metal-clad roofing, pre-cast concrete panels, metal-clad siding, low emissivity (Low-E) glass and levels located below grade. This is a separate system, but if installed, does require fire alarm monitoring.

9. Strict conformance to this specification is required to ensure that the installed and programmed system will function as design and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.

1.02 DEFINITIONS AND ACRONYMS

A. AHJ: Authority Having Jurisdiction, the individual or agency that has legal responsibility for reviewing the design for conformance with local codes and regulations.

B. ASME: American Society of Mechanical Engineers.

C. EoR: The Engineer of Record responsible for the Schematic Design drawings and project specifications

D. ERRCS: Emergency Responder Radio Communications System also known as a Public Safety or First Responder Distributed Antenna System.

E. FACP: Fire alarm control panel.

F. FM: FM Global (Factory Mutual).

G. Furnish: To supply the stated equipment or materials.

H. Install: To set in position and connect or adjust for use.

I. LED: Light-emitting diode.

J. NAC Booster: Notification Appliance Circuit audio and/or visual auxiliary power supply controlled and supervised by the FACP

K. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

L. NICET: National Institute for Certification in Engineering Technologies.

M. Schematic design drawings: drawings which establish the objectives and design criteria of the system along with locations of fire alarm equipment, a system concept riser diagram, identification of interface(s) required with fire safety functions, and identification of all initiating device and notification appliance locations.

N. Provide: To furnish and install the stated equipment or materials.

O. UL: Underwriters Laboratories.

1.03 PERFORMANCE-BASED DESIGN REQUIREMENTS

A. The system shall incorporate an alarm verification function in the fire alarm control unit for system type smoke detectors. Alarm verification shall not be provided for manual fire alarm boxes or water flow alarm switches.

B. All fire alarm control equipment, devices and conductors shall be protected against unwanted radiated electromagnetic interference (EMI) and radio frequency interference (RFI) which can interfere with normal system processing and possibly cause unwanted alarms.

C. Fire alarm technicians must be able to perform comprehensive tests on the system with minimum disruption to occupants. Fire alarm system control must originate from the control panel and/or programmable field devices. Individual bypass switches located at the main control panel must provide system wide bypass for each type of output to accommodate testing with minimal disruption.

D. Field located transponders, NAC power booster panels, and terminal cabinets as required to support the project, if locations not specifically provided on the design drawings. Good access must be provided for testing and maintenance requirements.

E. NFPA 72 10.4.4 require smoke detection coverage above critical fire alarm components. The quantity of required NAC booster panels vary between manufactures and their installation location(s) are determined by the Installation Contractor. If area smoke detection is not provided in the vendor-selected NAC booster panel location, then a dedicated smoke detector shall be provided above the panel. These locations shall be shown on the installation shop drawings and approved by the EoR and AHJ prior to installation.

F. SLC Circuit Design: Ground Fault Detection
   1. For addressable loops, ground fault detection shall be employed which can detect a ground fault on both the positive and negative side of each circuit. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground faults shall not interfere with normal operation, such as alarm, or other trouble conditions.
   2. In compliance with NFPA 72, section 23.6.1, provide fault isolation for every 50 devices on any SLC, limited to a maximum area of a floor or fire/smoke barrier compartment boundaries. Provide separate ground gault detection for each floor/ level.
   3. A single fault on a pathway connected to the addressable devices shall not cause the loss of the devices in more than one zone or area. If a floor of the building is subdivided into multiple zones by fire or smoke barriers and the fire plan for the protected premises allows relocation of occupants from the zone of origin to another zone on the same floor, each zone on the floor shall be considered a separate zone.
   4. Dedicated isolator modules or ground fault detection integrated into an addressable device may be used to ensure
   5. Acceptable wiring designs
      a. Install SLC loops with no more than 50 addressable devices circuit, homerun back to the panel. Each SLC must be internally isolated from shorts.
      b. Provide field circuit isolation with loop isolator devices installed as the first device and keeping the isolated legs of the circuit to fewer than 50 devices.

G. Initiating Device Installation
   1. Coordinate smoke detector locations with ceiling diffusers; none maybe closer than 3 feet.
   2. For ceiling tile applications, center detectors in the tile, inline with other ceiling fixtures.

1.04 SEQUENCE OF OPERATIONS

A. Alarm Sequence of Operation:
   1. Activation of a manual fire alarm box, automatic detector, or fire suppression system shall initiate the system to enter “alarm” mode including the following operations:
      a. Flash local LED red on the associated addressable device.
      b. Provide local English language annunciation of device location, address and condition, and audible and visual alarm signal at control panel and remote annunciators.
      c. Provide manual "acknowledge" function at control panel to silence audible alarm signal, visual signal remains displayed until initiating alarm is cleared.
      d. Transmit “alarm” signal to off-premises equipment to notify monitoring company.
      e. Activate fire alarm notification appliances.

f. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

B. Supervisory Sequence of Operation:
   1. Flash local LED red on the associated addressable device.
   2. Activation of gas detection, fire sprinkler tamper, pressure switch, duct mounted smoke detector or residential smoke detector with local audible base causes system shall initiate the system to enter "supervisory" mode including the following operations:
      a. Provide local English language annunciation of device location, address and condition, and audible and visual supervisory signal at control panel and remote annunciators.
      b. Provide manual "acknowledge" function at control panel and remote annunciators to silence audible supervisory signal, visual signal remains displayed until initiating supervisory is cleared. If AHJ approved, a supervisory condition may be programmed as self-restoring.
      c. Transmit "supervisory" signal to off-premises equipment to notify monitoring company.
      d. For HVAC applications: transmit signal to shut down air associated air handling unit and close associated fire/smoke dampers.
      e. For CO area detection applications: activate local NFPA 72 temporal-4 notification tone.

C. Trouble Sequence of Operation:
   1. System trouble, including single ground or open of supervised circuit, or power or system failure, initiate the system to enter "trouble" mode including the following operations:
      a. Flash local LED amber on the associated addressable device.
      b. Provide local English language annunciation of device location, address and condition, and audible and visual trouble signal at control panel and remote annunciators.
      c. Provide manual "acknowledge" function at control panel and remote annunciators to silence audible trouble signal, visual signal remains displayed until initiating trouble is cleared.
      d. Transmit "trouble" signal to off-premises equipment to notify monitoring company.

1.05 SEQUENCE OF INSTALLATION

A. This project is for the replacement of an existing fire alarm system
   1. The new fire alarm system shall be installed in parallel (tandem) with the existing fire alarm system. Temporary relocation/ mounting of equipment in order to maintain functionality is permitted. The existing fire alarm system must stay active during construction, meeting the following:
      a. Maintain manual fire alarm operation throughout the entire building (including areas under construction). Mark all non-operational manual pulls stations (existing, proposed, and/or temporary) ‘OUT OF SERVICE’.
      b. Maintain audible signaling devices to adequately warn building occupants and construction personnel (visual signaling is not required to comply with the ADA during construction).
      c. Maintain service to automatic fire detection as much as practical. Automatic heat detection may be temporarily substituted for smoke detection, as required. Automatic fire detection is not required to operate in areas of construction at times when

construction personnel are present (who can activate manual fire alarms). Other shutdowns of automatic fire detection may be considered, if approved in writing by the owner.

d. Whenever HVAC duct smoke detection systems are not operational during construction, the electrical contractor is responsible for maintaining clear and unobstructed access to HVAC controls and/or disconnecting means (to facilitate manual operation in the event of a fire).

e. Upon approval from the AHJ, the new system may be partially commissioned to accommodate phasing schedules. The new system shall be wired in such a way that when either the new or old system go into alarm, both systems go into alarm. The E.C. shall be responsible to ensure that spaces being monitored by the existing fire alarm continue to be monitored by the existing alarm until such time that they are switched over to monitoring by the new system.

f. Whenever unable to meet the above requirements, provide a continuous fire watch per AHJ requirements.

g. To satisfy requirements above, any existing and proposed life safety systems may be used as much as practical. Where requirements cannot be satisfied using existing/proposed systems, provide suitable temporary life safety systems (including all associated temporary wiring) as required. Where existing wiring is reused provide a written guarantee that it is acceptable for use with the equipment provided under this contract.

2. Before estimating work, visit the project site and verify all measurements and field conditions affecting the work. The contractor is fully responsible for the correctness of all measurements and for any connections to existing work. Submission of bid is considered evidence that this contractor has visited and examined the site. No extra consideration, claims, charges, or compensation will be granted under any circumstance for extra work as a result of the contractor's failure to visit the site or verify conditions and measurements.

3. Upon completion of all spaces being switched over to the new fire alarm system, the existing system shall be de-commissioning and removal of all related panels, field equipment and wire.

1.06 FIRE CONTROL PANEL – The system shall be a complete, electrically supervised fire detection and notification system, with a microprocessor-based operating system having the following capabilities, features, and capacities:

A. All control equipment shall be listed to the latest edition of UL Standard 864 (9th Edition}

B. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.

C. Audibles and visual notification signals shall be synchronized throughout the entire building.

D. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

E. The system shall be expandable and capable of providing a peer-to-peer network. Each panel shall have the ability to display either local panel activity or global network activity.

F. The system shall be capable of the following configurations. Both configurations are permitted on the same network.

a. The system shall support up to 252 addressable devices, which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
b. The system shall support two loops of 252 addressable devices, each of which may be divided in any ratio on one, or two, isolated Class A circuits.

G. The system shall be capable of remote monitoring via Windows Explorer, which provides a graphical representation of the fire alarm control panel at a remote PC when connected via Ethernet to the system. The display will show the exact state of the panel, including blinking LEDs, and with menu buttons for control.

H. Support of single-person test system and capable of providing point test reports in NFPA standard format without manual report entries.
1. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged in system history during the walk-test.
2. The control panel shall allow control and monitoring from a wireless handheld display device during maintenance, inspection and troubleshooting tasks
3. The control panel shall allow complete control and monitoring from a wireless handheld display device during one-man testing of the system
4. Testing supported should be real smoke testing of devices, automatically logged and made available in NFPA format reports. Manual test entries will not be accepted.

I. System shall provide an output port for monitoring purposes by external systems. Communications to an external system shall be RS-232 or RS-485 communications.

J. The local system shall provide status indicators and control switches for all of the following functions:
1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
2. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
3. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
4. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.
5. Any additional status or control functions as indicated on the schematic design drawings, including but not limited to: emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.

K. The system shall be compliant with the requirements of NFPA 720 as a Carbon Monoxide Detection Control Unit and shall meet the UL 2075 listing requirements. All inputs from CO sensors shall be indicated visually and audibly at the control panel. CO sensor inputs shall be distinct and descriptively annunciated from other signals.

L. Each intelligent addressable device or conventional zone on the system shall be displayed at the main fire alarm panel and each local fire alarm remote annunciator by a unique alphanumeric label identifying its location.

1.07 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72 installation methods, all contract documents and specification requirements.

1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.
2. Strobes shall be synchronized throughout the entire building.
3. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
4. Incorporate firefighter emergency communication systems, as specified.

B. Circuits and Pathways

1. The number of circuits and wire gauge shall be coordinated with the supplier's shop drawings.
2. Network Communications and vertical trunk wiring: all data wiring and audio risers shall be Class X, circuits as defined in NFPA 72, utilizing physically separated outgoing and return paths.
3. Addressable Signaling Line Circuit (SLC) wiring shall be configured as Class B circuits, with a minimum Level 0.
    a. Provide ground fault isolation detection and install NFPA 72 Class X circuit if quantity of addressable devices exceed 50 per circuit per NFPA 72 SLC survivability requirements.
    b. Provide separate SLC homeruns for each level or fire zone. A single wire fault shall not affect the operation of devices serving other areas.
    c. SLC capacity shall not exceed 80% of the number of each type of device the circuit is capable of supporting.
4. Notification Appliance Circuit (NAC) wiring shall be configured as Class B circuits.
    a. Appliance circuits shall be zoned to correspond with the building fire barriers and other building features.
    b. Provide separate NAC homerun’s for each level or evacuation signaling zone. A single wire fault shall not affect the operation of appliances serving other areas.
    c. NAC capacity shall not exceed 80% of the number of each type of appliance in active alarm condition.
    d. When NAC is used to activate an auxiliary notification booster panel, no other appliances shall be installed on that circuit.

C. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

D. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals and trouble signals shall be logged on the system printer and in system history during the walk test.

1.08 SUBMITTALS

A. The equipment supplier responsibilities will include the selection of equipment, devices and materials based on the schematic design drawings and project requirements, and their proper application based on the manufacturer’s limitations, operating characteristics and recommended practices.

1. Equipment quantities and locations shown on the schematic design drawing floorplans shall not be altered or modified without written approval of the Engineer of Record. Any

deviation from the Engineer's coordinated layout or design intent will constitute the submission as incomplete and shop drawings will not be approved.

2. Minor deviations, variations, changes, and corrections from layouts shown on the drawings (based on coordination, conditions, manufacturer's instructions, codes and standards, shop drawings, and verification of measurements and conditions) are permitted to facilitate construction provided the changes do not represent potential changes in scope of work and provided the changes are acceptable to the owner, architect, and engineer.
3. The equipment supplier shall coordinate the installation and system operation with the work of related trades.

B. Catalog manufacturer's product data sheets for all equipment, accessories and wiring with all applicable components being submitted for this project clearly noted. All equipment shall be subject to approval and no equipment shall be ordered without prior approval.

1. Data Sheets with multiple product shall highlight or identify the specific products utilized for this project.

C. System Calculations - Circuit calculations shall use the end-loading or point-to-point method described in NFPA recommended practices including both standby and active conditions. Complete calculations shall be provided which show the electrical load for all equipment and field circuits. (identify all mathematical formulas, variables, and constants used in all calculations) on the following system components:

1. Horn/ strobe 24VDC loads and spare capacity.

    a. NAC circuit (audible and visual) design shall incorporate a 20% spare capacity for future expansion.

2. Show wire size, estimated circuit length, and maximum allowable wiring distance as designed. Voltage drop calculations for wiring runs demonstrating worst-case condition.

3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.

D. The shop drawing submittal shall clearly indicate all proposed equipment and devices (type and quantity), with wiring diagrams, detailed operational sequences, and interfaces to related systems. They shall be prepared in accordance with NFPA 72 recommended practices and include the following:

1. Floor plans showing all devices and equipment to be installed with corresponding field settings, circuit, and device designations noted. Settings shall include the device address and candela rating as applicable. Circuit identifiers, device numbers and symbols used shall be clearly defined and consistent between all related documents. Whenever possible, the drawings shall reflect other components of the building such as air diffusers, HVAC returns, etc. to determine compliance or reference the associated mechanical design drawings.

    a. Floor plans at a scale of 1/8"=1'-0"
    b. When candela ratings are not shown on the schematic design drawings, utilize NFPA 72 visual coverage area tables to select coverage.

2. Complete point-to-point riser diagrams showing all equipment including size, type, number and reference designations for all circuits and devices. Each device shall be shown with address numbers or any other required field device settings including candela rating of notification appliances.

a. For multiple panel configurations, proved a separate block diagram to show the overall network system architecture with interconnection network circuits.

3. System panel drawings showing cabinet dimensions, internal module placement, field wiring terminations with spare capacity allowances, and any applicable operator's display and panel switch label assignments. Where multiple equipment cabinets are used in a single location these shall be shown together in elevation for coordination of equipment installation and wireways, and to ensure proper space allocation.

4. Provide a complete sequence of operation in the form of an NFPA input/output programming matrix for the entire system as shown in NFPA 72. The matrix shall reflect each unique programmed sequence, whether the sequence is initiated by an individual or common group of similar devices. Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions.

5. Installation drawings shop drawings, and as-built drawings shall be prepared by a NICET II or higher individual experienced with the work specified herein.

6. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.
   a. Disposition of shop drawings shall not relieve the Contractor from responsibility for deviations from drawings and specifications, unless the deviations are specifically noted in writing at the time of submission, and written acknowledgement has been received from the Engineer or Record. The disposition of shop drawings shall not relieve the Contractor from responsibility for errors in shop drawings or schedules.
   b. Copies of the approved shop drawings shall be maintained on-site to serve as working documents during installation for preparing as-builts.

E. Delegated Design Review of Shop Drawings: As required per the AHJ, in addition to items listed above, provide a compliance and code review by an individual with the required credentials and submit documentation, including any evaluation analysis of the shop drawing submittal. Provide the required review's credentials and seal/ signature by the qualified professional engineer responsible for the preparation, as required. The equipment supplier's shop drawings shall not be stamped or sealed by an Engineer unless the work is performed under their direct supervision and control.

1.09 QUALITY ASSURANCE

A. The following shall be adhered:

1. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.

2. Owner's best practices for fire alarm installations/ operations including compliance with site standard operating procedures (SOP's).

B. Equipment Supplier Qualifications

1. The supplied products must utilize multi-channel product distribution on a national basis to be considered for this bid. The distribution shall be from factory branches as well as independent distributors to allow the end user with the ability to utilize factory trained and authorized competitive service providers after system installation and commissioning. Single source system suppliers are not acceptable. The initial

installation and commissioning shall be provided by a factory direct branch to ensure a high level of quality for the customer.

2. A service office must be within 50 miles of the project site.
3. The manufacturer shall provide evidence of successfully installed similar fire detection and notification systems on comparable size and scope. The owner reserves the right to reject any installer's bid for which evidence of a successful prior installation by the contractor cannot be provided.
    a. The equipment and service provider shall have a minimum of 10 years' experience in the fire protective signaling systems industry.
4. Shall be licensed in the jurisdiction, if required.
5. The equipment supplier shall have a licensed fire protection engineer on staff to assist with all aspects of the installation including interfacing with the local AHJ and code consulting.
6. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.
7. The Equipment Supplier shall have in-house engineering and project management capability consistent with the requirements of this project. Factory trained representatives of the system manufacturer shall perform the detailed engineering of the system.

C. Installer Qualifications:
    1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.
    2. The contractor shall submit copies of all required licenses and bonds as required in the State having jurisdiction.
    3. The system installer shall work with the system supplier/designers to ensure all equipment is installed as shown in the Shop Drawings and manufacturer's requirements and programmed to comply with the project requirements.
    4. The installing contractor is responsible for coordination with related trades, and complete (1st party) testing of the system as installed, to include verification that the system performs as intended, and all devices and fault conditions are properly supervised and reported as specified herein.
D. Testing Agency Qualifications: Qualified for testing indicated.
E. Source Limitations for fire alarm equipment: Obtain fire alarm equipment from single source.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.
B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 WARRANTY

A. The equipment and wiring shall be warranted to be free from electrical, mechanical and performance defects, within the specified warranty period. Equipment and components that fail in materials or workmanship must be repaired or replaced. It shall include all labor/travel time, parts and programming. The warranty also provides for the adjustment of smoke detector sensitivities due to unwarranted or nuisance detector activations.
   1. Warranty Period: One year.
   2. Warranty Initiation: Commencing with start-up and owners beneficial use of any portion of the system.
   3. The warranty does not cover cases involving component failure due to abuse, misuse, and/or “Acts of God” including but not limited to lightning strikes, flooding, power surges, and fire.
   4. This warranty is void if the product is altered, repaired, or serviced by anyone other than original equipment installer.
   5. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.

B. All labor for administering and servicing the warranty, including actual replacement of parts, will be the responsibility of the Installer for the warranty period.

C. This Warranty does not apply to the replacement of consumable parts such as internal standby batteries. These components are designed to diminish over time unless failure has occurred due to a defect in materials, equipment malfunction, or expose to ambient conditions beyond their UL listing. As with all batteries, the maximum capacity and performance of the battery will decrease with time and use; this is not a defect. The expected lifespan of a fire alarm battery under normal conditions is 3 years. Only defective batteries and batteries that leak are covered by this warranty.

D. The Owner reserves the right to make changes to the fire alarm system during the Warranty Period. Such changes do not constitute a waiver of warranty. The contractor shall warrant parts and installation work regardless of any such changes made by Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the fire alarm system.

1.13 SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for 1 year.

B. Upgrade Service: Update software, firmware, to latest version at project completion. Install and program software upgrades that become available within one year from date of substantial completion. Upgrading software, firmware shall include operating system. Upgrade shall include new or revised licenses for use of software.

   1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.14 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. The following spare devices shall be supplied as applicable to this project:

1. Two (2) keys for each locked cabinet.
2. Two (2) of each type of smoke detectors.
3. Two (2) of each type of heat detectors.
4. Two (2) of each type of pull stations.
5. Four (4) of each type of pull station Lexan covers
6. Two (2) of each type of standard notification appliance(s) (horn, strobe & combination) installed.
7. Two (2) of each type of replaceable surge suppression modules installed.
8. Two (2) of each type of replaceable fuses installed in the system. Provide in a box or cabinet with compartments marked with fuse types, sizes and equipment locations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The equipment and service described in this specification are those supplied and supported by Siemens Industry and represent the base bid for the equipment.

1. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.

B. Must have multi-channel distribution for both products and equipment service. The owner shall have the ability change service provider or sales outlets. Proprietary manufactures such as single-channel suppliers are not acceptable.
1. The initial installation shall be completed by a factory direct office.

2.02 CONTROL PANEL

A. The fire alarm control panel shall be microprocessor-based using multiple microprocessors throughout the system, providing rapid processing of smoke detector and other initiation device information to control system output functions. The System Periphery board shall be capable of a minimum of 252 intelligent devices distributed between one, two, three, or four Class B SLC circuits. Any trouble on one circuit shall not affect the other circuit. The on board microprocessor provides the periphery board with the ability to function even if the main microprocessor fails. LED’s on the board shall provide annunciation for the following; Power, Gnd. Fault, Alarm, Trouble.

B. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal and reset the panel.

C. The Signal Line Circuits (SLC) shall be tested for opens, shorts and communications with all addressable devices installed before connection to the control panel. Systems without this capability shall have a test panel installed for initial testing to eliminate any possible damage short term or long term to the control panel. After initial testing replace the test panel and proceed with complete testing.
1. The signal line circuits (SLC) shall be polarity insensitive for all addressable devices. This permits the fire detection devices to operate even when detector and module wiring polarity are inverted on the wrong screw terminals.

D. The primary control panel interface shall have the ability to view events, acknowledge, silence, and reset the system and any networked Fire control panels, when configured as a global PMI. The standard operator interface can acknowledge, silence, and reset panels via Global PMI.

E. System response time from alarm to output shall be an average of three (3) seconds.

F. To expedite system troubleshooting, the system cards shall have ground fault detection and diagnostic LEDs by card.

G. All system cards and modules shall have Flash memory for downloading the latest module firmware.

H. Passwords:

1. Maintenance/Control Password - There shall be a 5-character password that a user must enter into the control panel in order to perform such maintenance- and control-related functions.

I. Networking – Command and Control:

1. A bidirectional data communications network transmitting multiplexed input and output signals, which shall be electronically supervised, shall connect all control panel nodes on a dedicated fire alarm network. The communication network shall consist of a communication circuits transmitting all system operations in a digitally encoded format.

2. Digital two-way communication capabilities supporting Style 4 (Class B) or Style 7 (Class A) communications using either hard-wired copper or fiber optics technologies or combinations of both as required for the control panels to communicate.

3. The system shall be designed such that in the event of a network communications failure, any remaining interconnected panels will operate as a sub-network and any isolated panels will operate in standalone mode. Upon communications failure, a trouble condition will be reported across the network and the disconnected panel shall continue to function in standalone mode.

4. Capability shall exist within the system to extend the network at any node. The system shall support a maximum of two network extension circuits in series on any system branch, extending the inherent distance limitations for network communications.

5. Communication protocol shall be of the CSMA/CD (carrier sense, multiple access, collision detect) type, eliminating delays incorporated into other protocols. Communication techniques using token passing and requiring sensing of delays and re-generation of the token to re-establish network communications in the event of a fault shall not be acceptable.

J. Software Modifications: The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made. Systems that require the use of external programmers or change of EPROMs are not acceptable.

K. Logic: The fire alarm system shall support generic functions that deal with binary states (True/False, high/low), and produce desired outputs from one or more binary inputs (for example, alarm outputs from spot detectors, VESDA detectors, monitor modules or manual station inputs). AND, OR, NOT, Any N, D Latch, RS Latch, Time Base Control, Start Timer, Restart Timer are generic functions. Generic functions can be used as inputs to other function. The system shall support 2500 logic functions.

L. History: The system shall store 5000 events in history while in straight mode and 4500 in circular mode. In straight mode, trouble warnings will occur at 4000 and 4500 events. In circular mode, the control panels shall maintain a 2000 event Alarm History buffer, which consists of the 2000 most recent alarm events from the 4500 event history file.

2.03 PRIMARY POWER SUPPLY

A. The control panels, NAC power booster panels, system workstation, and any other fire alarm equipment shall receive their primary power from a dedicated 120VAC disconnect circuit.

1. The circuit must be properly sized and protected in accordance with NEC requirements.
2. This requirement does not limit that one dedicated branch circuit to serving only one power supply within a system. The dedicated branch circuit could supply several fire alarm power supplies within a control unit or within multiple interconnected control units that serve the signaling system.
    a. The dedicated circuit can be supplied from any properly installed electrical panel board or sub-panel.
    b. Minimum capacity of 6-amp that provides 24VDC power for system operation.
    c. Ability to expand the power supply without adding additional cabinets.
3. The circuit disconnecting means shall be labeled 'FIRE ALARM' and any other local identification requirements. Its location must be listed at the point of connection to the fire alarm control equipment. Provide a dedicated breaker lock unless the breaker is located in locked panel board or if it is in a locked electrical room.
4. Transfer from AC to battery power shall be instantaneous when AC voltage drops less than 90% or brown out conditions it is not sufficient for normal operation.

B. Loss of primary AC power shall sound a trouble signal at the FACP. The FACP shall indicate when the system is operating on an alternate power supply.

2.04 SECONDARY POWER SUPPLY

A. When the primary AC power is lost, the system shall automatically switch to the secondary power supply.

B. The control panels, transponders, and NAC power booster panels shall receive their secondary power from batteries.
1. Battery shall be of the sealed lead-acid, maintenance free type, 24-volt nominal, suitable for life safety application.
2. Provide sufficient capacity to operate the complete alarm system in quiescent standby load (system operating in a non alarm condition) for a period of 24 hours and shall have sufficient capacity to operate all alarm notification appliances and all other connected loads for a period of 5 minutes.
3. The battery charger shall be able to charge the system batteries up to 100 AH batteries. Battery charging shall be microprocessor controlled and programmed to select battery sizes.
4. Transfer from AC to battery power shall be instantaneous when AC voltage drops to a point where it is not sufficient for normal operation.
5. Batteries shall be secured in seismic areas 2B, 3, or 4 as defined by the Building Code.

2.05 SYSTEM ENCLOSURE

A. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust resistant prime coat, and manufacturer's standard finish. The outer doors shall be capable of being a left hand open or a

right hand open. The inner door shall have a left-hand opening. System enclosure doors shall provide where required ventilation for the modules or cards in the enclosure.

B. Enclosure needed to hold all the cards and modules as specified with at least 25% spare capacity for extra cards.

C. Provide system enclosure for all amplifiers. Where required by the manufacturer, provide means for venting heat from the enclosure either by having enclosure sides and top vented or the doors vented.

2.06 DOCUMENT STORAGE BOX

1. With every new system, a documentation cabinet shall be installed at the system control unit or at another approved location at the protected premises. Where the documentation cabinet is not in the same location as the system control unit, its location shall be identified at the system control unit. It shall meet NFPA 72's record maintenance requirements and the following criteria:
   a. Enclosure to accommodate standard 8-1/2-by-11 inch and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information.
   b. Provide two key ring holders with location to mount standard business cards for key contact personnel.
   c. Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
   d. Color: Red powder-coat epoxy finish.
   e. Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
   f. Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.07 INITIATING DEVICES

A. General

1. The initiating device shall provide an alarm indication within less than four (4) seconds.

2. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections.

3. Operating Voltage: 24 VDC, nominal.

B. Multi-criteria Smoke Detectors – Addressable

1. The multi-criteria fire detectors shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in-duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detectors' communications shall allow the detectors to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installation and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of 19 environmental fire profiles unique to the devices installed location.
   a. UL Listed as "direct in-duct" mounting.
2. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.

3. Smoke detectors shall be analog sensors that utilize photoelectric-type sensing principles mounted within a smoke chamber to detect particles of combustion.
4. The control panel shall continually analyze the analog signal from each sensor to determine calibration, sensitivity and environmental changes that may affect sensor operation. The analog values from each device shall be displayed (in terms of percent of obscuration) at the control panel upon command.
5. The detectors shall have a tri-color LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm. Each detector shall include an LED that will flash periodically to indicate an active polling cycle. When the sensor reaches a predetermine alarm threshold (2% obscuration unless otherwise directed), the detector shall latch in LED shall flash continuously until reset at the control panel.
    a. The system shall have the ability to disable the detector's LED.
6. The detectors shall be UL listed for operation in a 95% relative humidity (RH) environment.
7. The detector shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes, and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.
8. The detectors shall support the use of a relay, or LED remote indicator without requiring an additional software address.
9. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.
10. Where indicated on the schematic design drawings, provide remote indicator lamps and identification plates for detectors concealed from view. Each indicator will illuminate when the detector is in alarm. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position in the nearest common corridor or otherwise designated on the floorplans.
11. When required, the detectors shall incorporate an addressable Carbon Monoxide (CO) sensor. The CO sensor shall be selectable as an input to the multi-criteria fire detector algorithm and as an independent life-safety CO gas detector (in compliance with NFPA 720).
    a. The multi-criteria detector with CO input shall be UL 2075 compliant as a gas and vapor detector.
12. The detectors shall be RoHS-compliant: it shall meet standards for Reduction of Hazardous Substances (RoHS) by reduction in lead content and other restricted substances.

C. Heat Detectors – Addressable

1. Thermal Detectors shall be analog/addressable sensors individually programmable for either fixed temperature, rate-of-rise or combined operation, except where otherwise dictated. The thermal detector shall be Model FDT421 and have the following temperature settings:

    a. Fixed temperature at 135°F, 145°F, 155°F, 165°F, 174°F
    b. Rate of Rise at 15°F/ min at 135°F
    c. Rate of Rise at 15°F/ min at 174°F

2. The detectors shall have a tri-color LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for

maintenance required, red for alarm. Each detector shall include an LED that will flash periodically to indicate an active polling cycle.

3. Analog sensors will also provide a low temperature warning (Supervisory condition) when the ambient temperature in a protected area reaches 40 degrees F.

4. Where ambient conditions dictate, provide conventional fixed temperature, weatherproof or explosion-proof heat detectors in lieu of analog detectors. Conventional devices shall be individually addressable via a dedicated addressable monitor module which shall be installed in an appropriately heated, ventilated location.

5. The detectors furnished shall have a listed spacing for coverage on smooth ceiling rating of up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage.

D. Duct Smoke Detectors – Addressable

1. The system supplier shall select the appropriate detector type, quantity and environmental configuration based on the manufacturer limitations, code requirements and the project HVAC system operating characteristics for air flow, velocity and environmental conditions.

2. Photoelectric type FDBZ-Series, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Where required there shall be available a duct housing with an on-board relay for fan shutdown.

   a. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
   b. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator.
   c. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
   d. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
   e. Duct smoke detector housing shall allow use in duct systems with air velocity ranging from 100 to 4,000 feet per minute, within temperature ranges of 32°F to 120°F per minute, and with relative humidity ranging from 0 to 95%.

3. Provide a remote LED indicator associated with the duct detector, as shown on the design drawings

4. Where duct detectors are exposed to the weather a weatherproof enclosure shall be available. A NEMA-3R and NEMA-4X option shall be available. The duct housing cover shall include a test port for functional testing of the detector without cover removal. The duct housing shall include a cover removal switch capable of indicating cover removal status to the fire alarm control panel.

5. Traditional area detectors may be substituted on ducts with access hatches within the manufacturer's limitations and applicable standards. When mounted directly in the HVAC air stream, detectors shall be rated for airflows ranging from 0 – 1000 feet per minute. Utilize pendant mounting to get the device in the center of the air flow. It must

be mounted to an appropriate electrical box mounted rigidly to withstand the pressure and resonant vibrations caused by the air velocity. The box pendant extension arrangement should be mounted from either the top or side walls extending to the center of the air duct stream. The access hatch shall be labeled to identify both the detector and HVAC unit it protects.

E. Detector Bases – Addressable

1. The plug-in detector bases shall be UL compatible with the selected detector head. They shall utilize screw clamp terminals and field circuits shall terminate directly to the base. Bases shall be installed directly on an industry standard 3 1⁄2-inch, 4-inch octagon boxes, and 4-inch square boxes (with or without plaster). Position decorative ring around the base as required per the manufacture. Provide the ability to make the detector base tamperproof to prevent the removal of the detector head without the use of a tool.
   a. The standard DB-11 base shall be - 6" version.

F. Carbon Monoxide Detectors

1. Carbon Monoxide Detectors: Provide Analog/Addressable sensors that include a CO sensing element where shown and required. Detectors may be either standalone sensors, or employ multi-sensing technology integrated with smoke sensors, and shall be Listed to the appropriate ANSI/UL standards, including UL 2075 (carbon monoxide), UL 268 (smoke) and UL 521 (thermal) as applicable.
2. The CO element shall operate between 30-560 parts per million (ppm), with a standard set point of 70ppm for exposure of 60 minutes accordance with NFPA 720. CO Sensors shall operate on non-resettable 24vdc power provided by the FACP and provide full analog values directly to the FACP. The detector shall have associated programmable control module outputs, and an integral piezo horn that produces 85dbA at 10ft. Activation of a CO Detector shall initiate a Priority 2 Supervisory CO Alarm event at the local Control Unit and Fire Response Center, and remote system Annunciators as described herein.
3. Multi-Criteria Fire Detector Model FDOOTC441 shall be listed as providing CO detection in duct application.
4. CO Sensors that are integrated into Mechanical Systems shall be designed for duct mounting or area detection, with a CO Alarm set point of not less than 50ppm, and be appropriately Listed by a Nationally-Recognized Testing Laboratory.
5. Sensors shall be provided and installed in accordance with the manufacturer's instructions. Sensors shall be monitored by the local Fire Alarm System for multiple alarm thresholds with corresponding addressable outputs to initiate equipment shutdown procedures and related life safety functions. Sensors will support periodic functional testing.
6. CO Sensors shall be monitored and programmed for Supervisory CO Alarm reporting in accordance with NFPA 720 and applicable code.

G. Manual Pull Stations – Addressable

1. Provide single-action addressable manual stations were shown on the schematic design drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting unique numeric address, identity, alarm and trouble to the fire alarm control panel.
   a. Station will mechanically latch upon operation and remain so until manually reset by opening with a supplied alien wrench.
   b. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE".

c. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Flying lead terminals are not permitted.

d. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.

2. Where shown on the schematic design drawings, provide a protective shield.

a. Shall be constructed of a clear LEXAN shield and red frame that easily fits over manual pull stations.

b. When shield is lifted to gain access to the station, a battery powered piercing warning speaker shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

3. Where required, there shall also be available pull stations with break glass, capable of explosion proof installation, capable of weatherproof installation, reset key operation, and metal housings.

H. Linear Beam Smoke Detectors

1. Line-of-sight beam type smoke detectors shall consist of infrared transmitter and receivers to detect smoke obscuration across large distances. The beam shall traverse the protected area and its' signal will be processed by the receiver to initiate the appropriate alarm response.
2. The detector shall cover distances from 30 to 325 feet and shall be designed, installed and adjusted to ensure there will be no interference from sunlight or high output lighting in the space.
3. Each beam detector set shall include transmitter, receiver, addressable monitor module and remote key-operated test station with LED alarm indicator and be powered from auxiliary 24VDC power from the local Fire Alarm Control Panel.
4. For areas with direct exposed sunlight, utilize and end-to-end beam detector with powered senders and receivers.
5. For areas without direct sunlight, utilize a single-point beam detector with a prism reflector with the ability to correct for slight building movement and self-correction alignment. Flat reflectors are not acceptable.

I. Addressable Monitoring and Control Modules

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive. The addressable interface modules shall be model number HTRI or FDCIO Series.

a. The modules shall support two operation modes: an isolator (polarity sensitive) or non-isolator (polarity insensitive) mode. The module shall be capable of being wired for either mode. During the isolator mode, the built-in dual isolators will work at both sides of the module to isolate the line short in front or behind the module.

1) Supports up to 252 addressable points per SLC devices loop, and in mixed mode up to 30 devices between isolated devices

b. Modules shall support NFPA 72 survivability requirements for shorts and provide information as to the location of the fault.
c. Each Model XTRI-series device has a multi-color LED that flashes when GREEN operating in Normal mode; AMBER if the unit is in a `Trouble' condition, and RED to indicate a change of status.
d. Provide non-obstructive front-end access to programming port and wiring terminals.

2. Isolator Module: Isolator module provides short circuit isolation for addressable notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings. Power and communications shall be supplied by the Addressable Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs. The following functionality shall be included in the Isolator module:

a. Report faults to the host FACP.
b. On-board Yellow LED provides module status.
c. After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.

2.08 DEVICE PROGRAMMING / TEST UNIT

A. The device programming unit is a tool used for installation, commissioning, maintenance and servicing of addressable devices. It shall program the intelligent devices with the assigned addresses and provide an electronic test to ensure proper operation. Programming dipswitches and/or rotary switches shall not be acceptable. The portable unit shall provide the following features:
1. Liquid-crystal display (LCD) screen with keypad
2. Built in addressable base as well as two external terminals for use with all other addressable ancillary devices.
3. Powered from on-board standard NiMH' rechargeable batteries or standard 'AA' Alkaline battery or an external AC adaptor.
4. Reads analogue values of addressable loops and preform maintenance features such as ground fault detection.
5. nonvolatile Flash memory with ability to download software upgrades.

B. The equipment supplier shall furnish a device programming unit to the installer for the duration of the project.

2.09 NOTIFICATION APPLIANCES

A. General requirements: Provide combination or individual audible and visual notification appliances as shown and permitted. All appliances shall be direct-wired; devices that utilize a multi-part assembly with swipe or non-mechanical pressure-type contact connections will not be considered acceptable.

1. Appliance housing available in red or white.
2. All field adjustments shall not require special tools or programming software for setting changes.
a. The selector switch for selecting the candela shall be tamper resistant.
3. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes
4. The contractor shall provide fitted surface mount backboxes supplied by the appliance manufacturer and outdoor-rated appliances where site conditions dictate.
5. wall or ceiling-mount applications.

6. 24VDC operation, operating by reverse-polarity.
7. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation.
8. Provide surface or semi-flush installations
9. Provide weather-proof appliances as shown on the drawings
    a. Extended temperature range of –40°F to 150°F (-40°C to 66°C).
    b. Listed for outdoor applications under UL 1638 as well as under UL 1971

B. Audible Horn Appliances:
    a. Evacuation signal shall be the ANSI 53.41 three-pulse temporal pattern. Sleeping areas shall have low-frequency 520 Hz audible signals.
        1) Horns shall be UL Listed (for indoor use under Standard 1971 and 464).
        2) High and Low audible outputs (90 & 95 dB)
        3) Selectable temporal or steady horn output.
    b. Provide high output re-entrant-type speakers with the appropriate weatherproof listings in outdoor or other high ambient noise areas, as shown on the schematic design drawings.

C. Visual Strobe Appliances:
    a. Visual-notification appliances shall meet and be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service.
    b. Strobe shall be listed for indoor use, and shall meet the requirements of FCC Part 15 Class B.
    c. Ability to mix LED and xenon strobes in the same field of view
    d. LED multi-candela strobe shall have field-selectable settings, and be rated per UL Standard 1971 for:
        1) Wall-mount: 15/30/75/110cd
        2) Ceiling mount: 15/30/75/95cd or 115/177cd ()
    2. The LED portions of the strobes shall meet the 20-millisecond light-pulse duration requirements of the 2016 edition of NFPA 72.
    3. All inputs shall be compatible with standard, reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP)
    4. The selector switch for selecting the candela shall be tamper resistant
    5. The strobes shall not drift out of synchronization at any time during operation
        a. If the sync module or Power Supply fails to operate, (i.e. - contacts remain closed), the strobe shall revert to a non-synchronized flash rate

2.10 MAGNETIC DOOR HOLD OPEN DEVICES

A. Door Hold Open Devices: Door hold open devices shall be operate from 24vdc power supplied by the local FACP. The Contractor shall coordinate the proper voltage of these devices with the door hardware supplier to ensure that all required hardware and wiring is provided

    1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
    2. Wall-Mounted Units: Flush mounted unless otherwise indicated.

B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush Surface cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 OFF-SITE STATUS REPORTING

A. Central Station Digital Communicator – Cellular Technology
   1. The commercial fire alarm off-site communicator shall provide general (alarm/ trouble/ supervisory) and ability for contact/ grouped event ID reporting from the fire alarm control panel (FACP). It shall be UL864 listed to provide point identification of alarm, supervisory, security and trouble events to a Central or Remove Receiving Station. It shall offer three selectable reporting paths which include: Cellular only, IP only, or IP primary/cellular backup. The Comminutor shall receive its power and supervision from the FACP.
      a. For this project, utilize cellular communications with IP communications as the primary means of communication to the off-site monitoring station, per NFPA 72 requirements. IP communications for owner selected/provided future option.
      b. The dual path communicator shall be provided with local cellular antenna. When the minimum cellular signal strength required by the manufacture's installation instructions cannot be met, provide an external antenna located and installed per field conditions, with the owners approval.
      c. Support selectable reporting paths and supervision intervals to meet NFPA 72, chapter 26 requirements.
      d. Cellular provide capability: With broadest coverage footprint available in Verizon or AT&T networks.
      e. Future IP communication works over any type of customer provided Ethernet 10/100 based network connection (LAN or WAN), DSL modem or cable modem. The equipment shall support both dynamic (DHCP) or Public and Private Static IP addressing.

B. The system shall provide the ability for real-time Fire Alarm Control Panel (FACP) remote connectivity and visibility of events from any iOS Android mobile device or computer browser interface. Cloud connectivity via client's IP network with optional cellular connectivity via separate modem using MQTT protocol. Features shall include:
   1. Dashboard with a live point-ID system status
   2. Communication shall be encrypted and secured by the manufacture's Gateway
   3. Email and App notifications customizable by the user
   4. Ability to view and download status reports
   5. Single portal application capable of viewing multiple connected FACPs
   6. Ability to remotely provide cybersecurity tests & updates
   7. Built-in firewall
   8. UL listed as ancillary notification

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

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

3.02 INSTALLATION

A. Perform work in accordance with the requirements of NFPA 70, NFPA 72, NFPA 13, NFPA 2001, and NECA , Standard of Good Workmanship in Electrical Contracting.

B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

C. In the event that limited energy cable installation is allowed, all cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and where installed in environmental air plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.

D. Backing Boards: Provide 3/4-inch marine plywood backing boards for support of all fire alarm equipment panels surface mounted on masonry walls.
   1. Paint both sides of boards with two (2) coats of Gray enamel, including all edges.

E. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

F. Wiring Integrity and survivability requirements – Specified on shop drawings per NFPA72, Chapter 12

G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

H. Provide Surge Protection Devices (SPD) on all fire alarm wiring, which extends beyond the main building. Locate the SPD as close as practicable to the point at which the circuit leave or enter the building where the Fire Alarm Control Panel is located. Protection devices shall be shown on the schematic design drawings and shall be UL listed or in accordance with written manufacturer's requirements.

   1. Provide equipment ground and connected to the building grounding electrode system per NEC.
   2. Provide a dedicated enclosure to house the SPD and label it.

I. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

J. Provide primary power for each panel from normal/ emergency panels as indicated on the Electrical Power Plans. Power shall be 120V AC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices.

3.03 BOXES, ENCLOSURES AND WIRING DEVICES

A. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

B. Fire Alarm: Terminal cabinets shall be provided in locations shown and as otherwise required to support wiring terminations, troubleshooting and future tenant fit-up. Cabinets shall be painted red and contain terminal blocks to support the system wiring where the Control Panels are remote from the devices served. Cabinets shall include accommodation for all wiring including SLCs, notification circuits, and related addressable and fault isolation modules for future expansion and modification.

1. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.

C. Boxes shall be installed plumb and firmly in position.

D. Extension rings with blank covers shall be installed on junction boxes where required.

E. Junction boxes served by concealed conduit shall be flush mounted.

F. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

G. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

H. Panel enclosures shall be installed to meet clearance requirements per NFPA 70 and local codes. Minimum requirements shall be 3 foot clearance in front of the enclosure

3.04 CONDUCTORS

A. Each conductor shall be identified as shown on the shop drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

C. All splices shall be made using solder-less connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

D. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

E. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

F. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.05 DEVICES

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

C. All devices and appliances shall be mounted to or in an approved electrical box.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Permanently label or mark each conductor with alphanumeric wire markers at the main control panel, transponders, terminal cabinet and NAC booster panels.

C. A consistent color code for fire alarm system conductors throughout the installation.

3.07 FIELD QUALITY CONTROL

A. 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. Testing General:

1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.

2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.

3. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the schematic design drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.

4. Test reports shall be delivered to the acceptance inspector as completed.

5. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installation contractor. The following equipment shall be a minimum for conducting the tests:

a. Ladders and scaffolds as required to access all installed equipment.

b. Multi-meter for reading voltage, current and resistance.

c. Two-way radios and flashlights.

d. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.

e. Decibel meter

f. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the authority having jurisdiction.

3.08 ACCEPTANCE TESTING

A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

1. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.
2. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

B. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that

all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

1. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
2. Visually inspect wiring.
3. Test the battery charger and batteries.
4. Verify that software control and data files have been entered or programmed into the FACP.
5. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
6. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
7. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.
8. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. Test results recorded for use at the final acceptance test.
9. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the owner and test results recorded for use at the final acceptance test.
10. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
11. Test each initiating device and notification appliance and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72 except that, for item 12(e) (Supervision) in Table 14.4.2.2, disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision shall be tested at each device.
12. All readings for Sound Pressure Level (SPL) shall be recorded on the installation drawings next to the speaker symbol. The readings shall then be added on the "as-Built" drawings to be submitted at the conclusion of the Final Acceptance test.
13. Verify with all parties the required survivability of wiring, raceways, and junction boxes
14. Determine that the system is operable under trouble conditions as specified.

C. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 30 calendar days prior to the test date. A final acceptance test will not be scheduled until the Preliminary Testing has been completed.

1. Provide documentation of Preliminary Testing results.
2. Test the system in accordance with the procedures outlined in NFPA 72 acceptance testing.
3. Demonstrate the performance of the required number and type of initiating devices and notification appliances per the AHJ’s requirements.
4. Verify that Shop Drawings reflecting as-built conditions are accurate. Upon final approval by all parties, provide two sets of As-built documents in a cabinet adjacent to

the main FACP or designated area within the building. Per NFPA 72 7.7.2Measure the current in Notification appliance circuits under full load to assure that there is the calculated spare capacity for every circuit.

D. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:

1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
    a. Open, shorted and grounded signal line circuits.
    b. Open, shorted and grounded notification, releasing circuits.
    c. Primary power or battery disconnected.
2. System notification appliances shall be demonstrated as follows:
    a. All alarm notification appliances actuate as programmed
    b. Audibility and visibility at required levels.
3. System indications shall be demonstrated as follows:
    a. Correct message display for each alarm input at the control display.
    b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.
    c. Correct history logging for all system activity.
4. System off-site reporting functions shall be demonstrated as follows:
    a. Correct zone transmitted for each alarm input
    b. Trouble signals received for disconnect
5. Secondary power capabilities shall be demonstrated as follows:
    a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created, and the system shall perform as specified for a period as specified.
    b. System primary power shall be restored for forty-eight hours, and system-charging current shall be normal trickle charge for a fully charged battery bank.
    c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

3.09 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following:

1. System record drawings and wiring details including one set of reproducible drawings, and a CD ROM or memory stick (thumb drive) with digital copies of the record drawings in PDF format.
2. System operation, installation and maintenance manuals.

3. System matrix showing interaction of all input signals with output commands.
4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
5. System program showing system functions, controls and labeling of equipment and devices.

3.10 PROTECTION

A. Remove and replace devices and panel components that are wet, moisture damaged, or mold damaged.

3.11 DEMONSTRATION

A. Include in the project the services of a factory-trained instructor, regarding the system operations, inspection requirements, and maintenance of the system provided. The instructor shall train the employees designated by the owner, in the care, adjustment, and operation of the fire alarm system.
   1. Required Instruction Time: Provide 2 hours of instruction after final acceptance of the system. The instruction shall be given during working hours on such dates and times as are selected by the owner. The instruction may be divided into two periods and videotaped at the discretion of the owner.

B. Provide a printed instruction card in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION

SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil.
2. Topsoil.

B. Related Requirements:
1. Section 312213 "Rough Grading" for removal of topsoil, rough grading, and filling associated with contouring of Site.
2. Section 312316.13 "Trenching, Excavation and Backfill" for excavating as required for building foundations and utilities within building perimeter.
3. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.

1.2 SUBMITTALS

A. Product Data:

1. Subsoil.
2. Topsoil.

B. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill to testing laboratory.

C. Source Quality-Control Reports: For subsoil and topsoil materials.

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates: For the source and origin for salvaged and reused subsoil and topsoil materials.

B. Product Certificates: For the source for regional subsoil and topsoil materials and distance from Project Site.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout Work.

B. Perform Work according to New Jersey standards.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey> Department of Transportation standards.
2. The Municipality of Pennsauken Department of Public Works standards.

2.2 SUBSOIL

A. Type S1.

B. Type S2 Ordinary Borrow:

1. Ordinary borrow consists of well-graded mineral soil substantially free of organic materials, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly.
2. Ordinary borrow consist of a material satisfactory to the Engineer Authority and not specified as gravel borrow, sand borrow, special borrow material, or other particular kind of borrow.
3. This material conforms to the physical characteristics of soils designated as group A-1, A-2-4, or A-3 under AASHTO M 145.
4. Must be readily spread and compacted for the formation of foundations, embankments, and other subgrade improvements.
5. Liquid Limit: A-1 and A-3 = none or not measured, A-2-4 = 40 max.
6. Plasticity Index: A-1 = 6 max, A-3 = Non-Plastic (NP), A-2-4 = 10 max.

C. Type S2-a Special Borrow:

1. Special borrow consists of one or all of the following:

a. A native in-situ soil that is classified under AASHTO M 145 as A-3, or that portion of A-1 and A-2 with less than 12 percent passing the No. 200 sieve as determined by AASHTO T 311.
b. A crushed rock, either obtained from ledge excavation on the Project or other approved sources, that meets the following requirements:

1) Percent of Wear LA Abrasion Test: 50 percent.
2) Maximum Plasticity Index: 6 percent.

c. Percent Passing According to Sieve Size:

1) 3 Inches (75 mm): 100.
2) 2 Inches (50 mm): 90 to 100.
3) No. 4 (4.75 mm): 100 to 60.
4) No. 200 (75 micro m): 0 to 12.

D. Type S2-b Pipe Bedding Material and Drainage Layer:

1. Bedding and drainage material under loam and around utilities is comprised of natural mineral sand within the following gradation limits:

    a. Percent Passing According to Sieve Size:

        1) 1/2 Inch (12 mm): 100.
        2) 3/8 Inch (10 mm): 100 to 85.
        3) No. 4 (4.75 mm): 100 to 60.
        4) No. 16 (1.18 mm): 80 to 35.
        5) No. 50 (300 micro m): 55 to 10.
        6) No. 200 (75 micro m): 10 to 2.

E. Type S2-c Granular Fill:

1. Granular fill consists of sandy gravel or gravely sand, free of organic material, loam, snow, ice, frozen soil, and other objectionable materials, well-graded within the following limits:

    a. Percent Passing According to Sieve Size:

        1) 4 Inches (100 mm): 100.
        2) 1/2 Inch (12 mm): 85 to 50.
        3) No. 4 (4.75 mm): 75 to 40.
        4) No. 100 (150 micro m): 30 to 5.
        5) No. 200 (75 micro m): 20 to 0.

F. Type S2-d Structural Fill:

1. Structural fill consists of processed fill material that is hard durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation requirements as determined by AASHTO T11 and T27 conforms to the following gradation requirements:

    a. Percent Passing According to Sieve Size:

        1) 3 Inches (75 mm): 100.
        2) 1/2 Inch (12 mm): 50 to 85.
        3) No. 4 (4.75 mm): 40 to 75.
        4) No. 50 (300 micro m): 8 to 28.
        5) No. 200 (75 micro m): 0 to 8.

G. Type S2-f Lightweight Aggregate Fill (LWAF):

1. LWAF is a rotary kiln expanded shale aggregate manufactured by Solite Corporation of Saugerties, NY, or Norlite Corporation of Chores, NY, or an approved equivalent. No byproduct slags, coal derived by-product aggregates (cinders, bottom ash, fly ash), or pumice, scoria, or tuff are permitted. The aggregate shall meet the requirements of ASTM C330 and consist of tough, durable, non-corrosive particles with the following gradation:

    a. Percent Passing According to Sieve Size:

1) 1 Inch (25 mm): 100.
2) 3/4 Inch (19 mm): 90 to 100.
3) 3/8 Inch (10 mm): 10 to 50.
4) No. 4 (4.75 mm): 0 to 15.
5) No. 8 (2.36 mm): 0 to 5.

2. The maximum soundness loss when tested in accordance with ASTM C88 with five (5) cycles of magnesium sulphate may not exceed 10 percent.
3. The maximum Los Angeles abrasion loss when tested in accordance with ASTM C131 (B-Grading) will be 50 percent.
4. The maximum chloride content when tested in accordance with the AASHTO T260 (acid solution) will be 100 ppm.
5. The maximum compacted moist density can not exceed 60 pcf when tested in accordance with ASTM D698 (one point test at typical moisture content when shipped to site).
6. The specific gravity when tested in accordance with ASTM C127 will be no less than 1.4.
7. The angle of internal friction will be no less than 40 degrees when tested in accordance with AASHTO T236.

2.3 TOPSOIL

A. Type S3: Comply with the following standards.

1.	Organic Matter, AASHTO T 267	3% to 10%
2.	Sand, AASHTO T 88	20% to 70%
3.	Silt, AASHTO T 88	10% to 60%
4.	Clay, AASHTO T 88	5% to 30 %
5.	pH, AASHTO T 289	6% to 8%

B. Type S4:

1. Excavated and reused material, Select, or Unclassified to be approved by the engineer.
2. Graded and double screened.
3. Free of roots, rocks larger than 1/2-inch, subsoil, debris, large weeds, and foreign matter.
4. Comply with ASTM D2487 Group Symbol OH, PT.

C. Type S5 Imported Base Loam:

1. Imported base loam is comprised of a naturally occurring soil from geological soil forming processes, without admixtures of sand or organic matter sources (composts). Provide imported base loam as required for blending with sand and compost.
2. Imported base loam that has been contaminated by incorporation of subsoil is not acceptable for use.
3. Imported base loam for the Work is required to be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter or debris. Imported base loam composition is required to be free of quack-grass rhizomes, Agropyron repens, and the nut-like tubers of nutgrass, Cyperus esculentus, and other primary noxious weeds.
4. Do not deliver imported base loam for use or planting while in a frozen or muddy condition. Provide imported base loam for mixing which conforms to the following grain size distribution for material passing the No. 10 sieve:

a. Percent Passing According to Sieve Size:

1) No. 10 (2.2 mm): 100%.
2) No. 18 (1.0 mm): 85% to 100%.
3) No. 35 (500 micro m): 70% to 95%.
4) No. 60 (250 micro m): 50% to 85%.
5) No. 140 (106 micro m): 36% to 53%.
6) No. 270 (53 micro m): 32% to 42%.
7) 0.00008 inch (0.002 mm): 3% to 6%.

5. The organic content must be between 4.0 and 8.0 percent by weight.
6. pH must be between 5.8 and 7.0.
7. Undertake chemical analysis for phosphorus, potassium, calcium magnesium, aluminum, iron, manganese, lead, cation exchange capacity, soluble salts, acidity (pH) and buffer pH.

D. Topsoil shall be loamy sand, sandy loam, clay loam, loam, silt loam, sandy loam or other soil approved by the Engineer. It shall not have a mixture of subsoil and contain no slag, cinders, stones, lumps of soil, sticks, roots, trash or other extraneous materials larger than 1-1/2" diameter. Topsoil must also be free of viable plants or plant parts of bermuda grass, quackgrass, johnson grass, nut sedge, poison ivy, Canada Thistle or others as specified. All topsoil shall be tested by a reputable laboratory for pH and to a range of 6.0 - 7.0 Soluble salts shall not be higher than 500 parts per million. Topsoiling shall conform to Section 917 of the New Jersey Department of Transportation (NJDOT), Standard Specifications 2019.

E. Lime, shall be Agricultural limestone (dolomite) containing not less than 85 percent of calcium carbonate or calcium carbonate equivalent; meeting the following minimum gradations, 100 percent passing a 10 mesh sieve, 98 percent a 20 mesh sieve, 55 percent a 60 mesh sieve, and 40 percent a 100 mesh sieve; delivered in original unopened containers with the identifying marks and analysis meeting specification requirements.

F. Commercial Fertilizer shall be uniform in composition free flowing and suitable for application with approved spreader; granular or pelleted with 50 percent of total nitrogen derived from natural organic material in a slowly available form; delivered in unopened containers with the analysis type and trade name attached to each container. Fertilizer shall be a 10-6-4 formula and applied at the rates shown on the drawings or as otherwise specified. Also, the fertilizer composition shall comply with all applicable regulatory agencies.

G. Sod and Seeding

1. Seed Mixes shall be as follows:

Type A-3 Grass Seed Mixture

Kind of Seed	Minimum Purity Percent	Minimum Germination Percent	Percent Total Weight of Mixture
Tall Fescue (Rebel or Falcon)	95	80	60

Kentucky Bluegrass (Kenblue, South Dakota or Park)	85	75	10
Chewings Fescue (Highlight or Jamestown)	95	85	20
Perennial Ryegrass (Linn)	98	85	10

Type D Grass Seed Mixture

Kind of Seed	Minimum Purity Percent	Minimum Germination Percent	Percent Total Weight of Mixture
Kentucky Bluegrass	85	75	50
Red Fescue (Creeping or Chewings)	95	85	35
Redtop	92	85	5
Perennial Ryegrass	95	80	10

2. The seed shall be delivered to the job site in original, unopened containers bearing the grower's or dealer's guarantee of analysis. Wet, moldy or otherwise contaminated seed shall be rejected.

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis:

1. Subsoil Material: Comply with AASHTO T 180; ASTM D698; ASTM D1557; ASTM D6938.
2. Topsoil Material: Comply with AASHTO T 180; ASTM D698; ASTM D1557; ASTM D6938.
3. If tests indicate materials do not meet specified requirements, change material and retest.

B. Owner Inspection:

1. Make subsoil and topsoil available for inspection at source prior to packaging for shipment.
2. Notify Owner at least seven (7) days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of source testing at supplier's test facility.
2. Notify Owner at least seven (7) days before tests are scheduled.

D. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

3.2 INSTALLATION OF SUBSOIL AND TOPSOIL

A. Excavation:

1. Excavate subsoil and topsoil from designated areas.
2. Strip topsoil to full depth of topsoil in designated areas.
3. Remove excess excavated materials, subsoil, and topsoil not intended for reuse from Site.
4. Remove excavated materials not meeting requirements for subsoil and topsoil materials from Site.

B. Stockpiling:

1. Stockpile excavated material meeting requirements for subsoil and topsoil materials.
2. Stockpile materials on Site at locations as indicated.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate differing materials with dividers or stockpile apart to prevent intermixing of soil types or contamination.
5. Stockpile topsoil maximum 8 feet high.
6. Direct surface water away from stockpile to prevent erosion or deterioration of materials.
7. Stockpile unsuitable hazardous materials on impervious material and cover to prevent erosion and leaching until they are disposed.

3.3 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.

    a. Grade Site surface to prevent freestanding surface water.

2. Leave unused materials in neat, compact stockpile.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

4.1 All costs for Soils for Earthwork shall be included under the line idem “FINAL SITE RESTORATION AND LANDSCAPING, COMPETE” as listed in the bid form. Such price shall include but not limited to: grading, site improvements, tree and plant protection, landscaping, site restoration, concrete and asphalt paving such as driveway extension and restoration, concrete driveway apron and concrete curb, chain link fences and gates, clean up and waste disposal and all other work in connection therewith or incidental thereto.

END OF SECTION 310513

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Site Clearing consists of clearing of the site within the limits of construction to include the following:
   1. Removal and disposal of trees and brush, weeds, roots, and similar materials.
   2. Removal and disposal of structures and all other obstructions which are designated for removal by the Engineer during construction and for which payment is not otherwise provided in the Contract.
   3. Site Regrading.

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 SUMMARY

A. Section Includes:

   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Stripping and stockpiling rock.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and abandoning site utilities in place.

1.4 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

C. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 3105113 "Soils for Earthwork "

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction. Roads, structures, pavement areas, grass, or landscaping to remain shall be protected by Contractor in a manner approved by the Engineer.

B. Grade all grubbed and cleared areas as shown on contract drawings.

C. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

D. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.3 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be removed or abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction and site piping.
1. Clear the project site within the limits of construction shown on the drawings, or as directed by the Engineer.
2. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
3. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18-inches below exposed subgrade.
4. Use only hand methods or air spade for grubbing within protection zones.
5. Chip removed tree branches and stockpile in areas approved by Engineer or dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

PART 4 – QUANTITY AND PAYMENT

A. Site Clearing

1. All costs for Site Clearing shall be included under the line idem “SITE CLEARING, ROUGH GRADING, EXCAVATION, HAULING AND GRADING, COMPETE” as provided on the bid form. Such price shall include but not limited to: excavation, trenching, fill, stockpiling, grubbing removal of bushes and vegetation, equipment and all else necessary therefore and all other work in connection therewith and incidental thereto.

END OF SECTION 311000

SECTION 312213 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, compacting, and Site for Site structures and building pads

B. Related Requirements:
1. Section 311000 "Site Clearing" for excavating topsoil.
2. Section 312316 "Excavation" for building excavation.
3. Section 312316.13 "Trenching" for trenching and backfilling for utilities.
4. Section 312323 "Fill" for general building area backfilling.

1.2 SUBMITTALS

A. Source Quality-Control Reports: For subsoil and topsoil.

B. Material Test Reports: For each fill material, by a qualified testing agency.

C. Field Quality-Control Reports: For fill material placement and compaction.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of remaining utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 QUALITY ASSURANCE

A. Perform Work according to ASTM C136, ASTM D2419, and ASTM D2434.

B. Furnish each coarse and fine aggregate material from a single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.

2.2 MATERIALS

A. Topsoil: Shall conform to Subsection 917.01 of the NJDOT Standard Specifications.

B. Subsoil Fill: Type S2.

C. Structural Fill: Type S2.

D. Granular Fill: Type A3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

B. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call local utility line information service not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain free from damage.

E. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

F. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in continuous layers and compact according to schedule in Evaluations.

C. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inchescompacted depth.
2. Structural Fill: Maximum 6 inches compacted depth.
3. Granular Fill: Maximum 6 inches compacted depth.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building with a minimum [2 percent slope for minimum distance of 10 feet, unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Repair or replace items damaged by excavation or filling.

H. Install Work according to [State of New Jersey (NJ) Municipality of Pennsauken of Public Works standards.

3.4 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1.2 inches from required elevation.

3.5 FIELD QUALITY CONTROL

A. Perform laboratory material tests according to ASTM D1557 ASTM D698 AASHTO T 180.

B. Perform in-place compaction tests according to the following:

1. Density Tests: ASTM D1556.
2. Moisture Tests: ASTM D6938.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Prepare test and inspection reports.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

4.1 All costs for Rough Grading shall be included under the line idem “SITE CLEARING, ROUGH GRADING, EXCAVATION, HAULING AND GRADING COMPETE” as provided on the bid form. Such price shall include but not limited to: excavation, trenching, fill, stockpiling, grubbing removal of bushes and vegeration, equipment and all else necessary therefore and all other work in connection therewith and incidental thereto

END OF SECTION 312213

SECTION 312316.13 – TRENCHING EXCAVATION AND BACKFILL

PART 1 - GENERAL

A. Excavation and backfill shall include the excavation and backfilling for all work including but not limited to manholes, inlets, sanitary sewer, sump drain, force main, water main, force main and all appurtenances at the required locations, as shown on the drawings and specifications for all materials of whatsoever nature encountered.

B. Only those portions of the site which are absolutely necessary and essential for construction shall be cleared. Whenever possible, excavation shall include the removal and storage of topsoil from the site for future use. The length of time of ground disturbance shall be reduced to the minimum practicable, especially in environmentally critical areas. Ground disturbance shall be avoided until immediately preceding construction to minimize exposure of soils.

C. Prior to excavation all impervious surfaces shall be saw cut.

1.2 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Fill materials.
4. Trench shoring shields or boxes.
5. Temporary steel plates.
6. Backfilling and compaction.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete materials.
2. Section 310513 "Soils for Earthwork" for soils for fill.
3. Section 310516 "Aggregates for Earthwork" for aggregates for fill.
4. Section 312213 "Rough Grading" for topsoil and subsoil removal from Site surface.
5. Section 312316 "Excavation" for general building excavation.
6. Section 312323 "Fill" for general backfilling.
7. Section 333100 "Sanitary Sewerage Piping" for sanitary sewer piping and bedding from building to utility service
8. Document for geotechnical report, bore hole locations, and findings of subsurface materials in appendix

1.3 DEFINITIONS

A. Excavator: Any entity including, but not limited to, a person, partnership, joint venture, trust, corporation, association, public utility, company, or state or local government body or public agency which performs excavation operations, including the excavation of trenches.

B. Trench: An excavation which is narrow in relation to its length and deeper than it is wide, made more than three feet below grade, with width no greater than 15 feet as measured from the bottom.

C. Trench Shoring: The methods and equipment, including shores and props, used to brace the walls of a trench during excavation work and to prevent the trench walls from collapsing into the trench. Also referred to as trench bracing or trench lining.

D. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, trench shoring shields, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Prepare design calculations and drawings, stamped and signed by a professional engineer registered in the State of New Jersey, who is experienced in designing excavation support systems.

B. Product Data: Submit data for sheeting, shoring, trench shoring shields, and geotextile fabric indicating fabric and construction.

1.5 PROTECTION OF UNDERGROUND FACILITIES

A. The Contractor will conduct an investigation to assure that no damage to existing structures, drainage lines, utilities, or conduits will occur.

B. The Contractor is required to use caution when encountering active or abandoned utility structures to avoid possibly disturbing or damaging asbestos-containing materials (ACM), which may be present. The Contractor] will notify the Engineer of any suspected ACM encountered in Site utility structures and is responsible for arranging testing of the suspect material by polarized light microscopy (PLM) or other approved method before proceeding with any Work that would disturb the structures.

C. While the excavation is open, protect, support, or remove underground installations as necessary.

PART 2 - PRODUCTS

2.1 MATERIAL

A. The Contractor shall, at his expense, make such test pits and borings along the line and site of the work to satisfy himself regarding the character of the various strata of sub-surface materials and the amount of ground water that may be encountered in the course of construction and shall bid accordingly and the unit/lump sum prices bid for the various pipes or structures requiring excavation shall include the difficulties to be encountered in excavation. Excavation shall include all materials excavated, encountered, including but not limited to rock, earth, shale, quicksand, gravel, sand, cinders, broken stone, concrete, paving, filled material, etc., and all miscellaneous excavation not herein specified and classified.

B. Backfill material from on-site excavation: All on-site backfill materials shall be subject to the approval of the Engineer, and to the following requirements.
   1. Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay.
   2. Free of large rocks or lumps larger than two inches (2") in greatest dimension that may create voids or prevent proper compaction.
   3. Criteria for use of on-site materials is that it must meet at least the criteria of I-13 and meet all requirements of Section 901.09 and meet the gradation specified in Table 901-2 of the Standard Specifications.

C. Backfill for Ductile Iron Pipe:

   1. Stone for trench stabilization (if and where directed):
      Trench stabilization material for bedding under pipes and structures shall be broken stone conforming to Section 901.04 of the Standard Specifications, and meeting the gradation specified in Table 901-1. Size shall be No. 57 (modified).
   2. Imported Select backfill (if and where directed) for pipes shall meet at least the criteria for I-13 and meet all the requirements of Section 901.09 and meeting the gradation specified in Table
      901-2 of the Standard Specifications.

D. Backfill for P.V.C. Pipe:

   1. Initial Backfill: Initial backfill will be defined as the backfilling of the trench beginning at the springline to a point 12" above top of pipe. The material shall be Soil Aggregate Designation I-8 conforming to the requirements of Section 901.21, Table 901-2 of the Standard Specifications. Little or no tamping is required of the initial backfill. In no case shall compaction equipment be used directly over the pipe.
   2. Haunching: Haunching will be defined as the area of the trench from the bottom of the pipe to the springline. The haunching material shall be a well graded crushed stone, conforming to Section 901.08, and Table 901-1, Size No. 57(modified) of the Standard Specifications. The stone shall be thoroughly compacted to a maximum density of 95% by means of a hand tamper. Extreme care should be used in order to avoid contact between the pipe and compacting equipment.
   3. Bedding: Bedding will be defined as the area of the trench from the bottom of the pipe to a line 6" below the bottom of the pipe. It shall be broken stone conforming to Section 901.04 of the Standard Specifications, and meeting the gradation specified in Table 901-1. Size shall be No. 57(modified).
   4. Select Backfill & Trench Stabilization (if and where directed): shall be as specified for Ductile Iron Pipe.

2.2 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

   1. The State of New Jersey (NJ) Department of Transportation standards.
   2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.3 FILL MATERIALS

A. Subsoil Fill: Type S2.

B. Structural Fill: Type S1.

C. Granular Fill: Type A3.

D. Concrete: Flowable fill.

2.4 TRENCH SHORING SHIELDS OR BOXES

A. Provide professional engineer-certified, high-strength, single-wall or double-wall 6061-T6 aluminum alloy trench shields or boxes with the following characteristics:

1. Modular shoring system.
2. 8-inch wall thickness standard.
3. Foam-filled option.
4. Interchangeable Widths: 5-inch, 6-inch, 8-inch Schedule 80 pinned-in-place steel pipe spreaders.
5. Lifting lugs standard.
6. Hardwood filled top boards.
7. Stackable.
8. Reinforced cutting edges.
9. Choice of Heights: 4-foot, 6-foot, 8-foot, or 10-foot high panels.
10. Minimum five standard lengths.
11. Dual purpose end posts accept either panels, screw jacks, or spreaders allowing two-, three-, or four-sided shields using the same components.

B. Manufacturers:

1. American Shoring Inc.
2. ESC Trench Shoring.
3. PRO-TEC Equipment.
4. Trench Shoring Company.

2.5 TEMPORARY STEEL PLATES

A. Place temporary steel plates over all saw cuts and trenches in roadway areas that will be subjected to traffic during installations to allow for the passage of vehicular traffic.

B. Design the steel plates to size and thickness capable of supporting HS-20 loading, but not less than one inch thick.

C. Submit design criteria and calculations that determine the sizes to be used to Architect/Engineer for approval.

D. Completely cover the opening with plates and overlap a minimum of 24 inches on all sides.

1. Secure the plates to pavement with spikes or similar devices to prevent any movement of the plates.
2. Place bituminous concrete around the edges of the steel plating to provide a smooth transition on and off the plates for vehicles.
3. When the steel plating is removed, also remove the temporary bituminous concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

B. Proceed with trench excavation only after unsatisfactory conditions have been corrected.

3.2 LINES AND GRADES

A. Lay pipes and conduit to lines and grades as indicated on Drawings.

1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

3.3 Use laser-beam instrument with qualified operator to establish lines and grades.PREPARATION

A. Call local utility line information service at not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.
2. If utilities are to remain in place, provide adequate means of protecting during trench excavation operations.
3. Should uncharted or incorrectly charted piping or other utilities be encountered during trench excavation, consult Engineer immediately for directions. Cooperate with Engineer and public utility service companies as required to keep their respective services and facilities in operation. Repair damaged utilities to the satisfaction of Engineer.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above- and below-grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.4 GENERAL EXCAVATION

A. Excavation of all materials of whatsoever nature encountered shall be made to the lines and grades shown on the drawings, or as may be necessary to fully carry out the intent of the drawings, and of these specifications, where no grades are indicated or described. Surfaces of excavations in earth, exposed in the finished work, both level and sloped, shall be excavated in planes four inches lower than the finished surfaces, measured perpendicularly to the drawings, and shall be brought up to the finished surfaces with 4" top soil as specified elsewhere. Finished surfaces shall be true to line and grade and shall be dressed to even planes. Unless otherwise shown or stated on the drawings, all exposed slopes shall be in accordance with OSHA regulations. Slopes shall be kept true to line and grade during the progress of the work, and should any slope be scoured by storm water, or otherwise disturbed, or should any excavation be scoured or disturbed before final payment is made, the Contractor shall promptly restore the slope or excavation so scoured, gullied or otherwise disturbed to line and grade before final payment is made. No additional compensation will be paid the Contractor by reason of the encountering of any unusual or unexpected subsoil conditions.

B. Where required, the Contractor shall provide sheathing and shoring to maintain the stability of side slopes or limit the width of excavation so not to disturb adjacent structures, paving or utilities at no additional cost to the Owner.

3.5 TRENCHING

A. Remove lumped subsoil, boulders, and rock more than 1/6 cu. yd., measured by volume.

B. Perform excavation within 24 inches of existing utility service according to utility's requirements.

C. Do not advance open trench more than 200 feet ahead of installed pipe or conduit.

D. Cut trenches to width as indicated on Drawings sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work according to OSHA 29 CFR 1926.650. In excavating for all pipes, inlets and manholes, the trenches between the lines of sheathing, if sheathing is used, must be of sufficient width to permit the work to be constructed in the manner and of the size specified. All excavating shall be confined within the narrowest possible limit and made as nearly as possible in a vertical line.

E. All trenches shall be excavated on the lines designated by the Engineer and to the grades and depths necessary for the laying of pipes at the grades given by him. The lines and grades given by the Engineer shall, in general, consist of a benchmark for elevation control and a baseline and from this point on, Contractor shall lay out his own work and build.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe or conduit.

G. Excavate trenches to depth as indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe. Where, in the opinion of the Engineer, the original depth is sufficiently compact and solid for the foundation of the work, the bottom of the trench shall be

excavated to conform to the external form of the pipe and under each bell or joint, unless the pipe is laid on a plank foundation, the trench shall be so hollowed out as to allow the body of the pipe to have a bearing throughout on the trench bottom and to provide ample room for the making of joint.

H. Do not interfere with 45-degree bearing splay of trench or foundations.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe or conduit. When side walls cannot be sloped, provide sheeting and trench shoring shields to protect excavation as specified in this Section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered Engineer and request instructions.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type and compact to density equal to or greater than requirements for subsequent backfill material.

L. Trim excavation. Remove loose matter.

M. Correct over-excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

N. The Contractor shall not, without permission from the Engineer, remove from the line of the work any excavated materials which may be suitable for filling the trench or excavation until the same has been refilled. All excess excavation shall remain the property of the Owner and shall be disposed of at the location so designated by the Owner within the limits of the Municipality at the Contractor's expense. However, if the Owner has no real need for this excess excavation, it shall be the Contractor's responsibility to dispose of said material at no expense to the Owner. Excess excavation shall be immediately removed.

3.6 EXAVATED MATERIAL

A. The materials excavated shall be laid compactly on the side of the trench or excavation and kept trimmed as to be of as little inconvenience as possible to the travelling public and to adjoining tenants. Where the streets are paved, the paving materials shall be kept separate from the other materials excavated. All streets shall be kept open for travel unless otherwise directed by the Engineer.

3.7 SHEETING, SHORING, AND TRENCH SHORING SHIELDS

A. All faces of excavation shall be properly sheeted, timbered and braced where necessary to furnish suitable dry and safe working conditions acceptable to the Engineer, to preserve the load carrying capacity of the soil, to keep the excavation within the narrowest possible limit to protect any structure or paving adjacent to or close to the trenches, or work of excavation from damages.

B. Bracing shall be so arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide the necessary strength as determined by the Engineer. Any damage to the pipelines or structures occurring through

settlement, water or earth pressure, slides, caves or other causes shall be repaired by the Contractor at no cost to the Owner.

C. The Contractor shall include in the unit prices bid for the various items the cost involved in the shoring, sheathing, bracing and timbering and the maintenance, etc. of the trenches and other excavation during construction.

D. The Contractor shall be held responsible for the protection of all subsurface and above-ground utilities, adjacent structures, buildings, curbs, sidewalks and street pavement from any settlement, destruction, or damage and for the maintenance of same during construction and for any repair, replacement or restoration of same without cost therefor to the Owner, resulting from the installation of the work under this contract from the time of completion for a period of one year thereafter to the satisfaction of the Owner.

E. The Contractor shall, notify the Engineer of the removal of any of the sheathing, shoring, bracing or timbering, but such notification is not to be construed as relieving the Contractor of his obligation and responsibility to adequately safeguard said adjacent structure, nor shall it relieve the Contractor of the liability for claims for damage incidental thereto.

F. Support trenches more than 5 feet <Insert> deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, trench shoring shields, or other protection to maintain stability of excavation.

G. When sheeting is used, drive it ahead of the excavation operations to avoid the loss of material from behind the sheeting. Fill voids that occur outside of the sheeting with gravel borrow, thoroughly compacted.

H. Assemble and place trench shoring shields according to manufacturer's written instructions.

I. Design sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade. There shall be no payment for sheathing or shoring left in place, but the cost of same shall be included in the unit price bid for the various sewer lines.

J. Design sheeting and shoring to be removed at completion of excavation Work.

K. Repair damage caused by failure of the sheeting, shoring, trench shoring shields, or bracing and for settlement of filled excavations or adjacent soil.

L. Repair damage to new and existing Work from settlement, water pressure, earth pressure, or other causes resulting from inadequate sheeting, shoring, trench shoring shields, or bracing.

3.8 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. The backfilling of the trench will be filled by using properly compacted, common earth material. If sufficient earth cannot be obtained to completely fill the trenches, the Contractor shall use Select Backfill as defined in this Section.

C. Should excavated material be clay that will not consolidate by ordinary methods of backfilling, it shall be removed from the site and replaced with Select Backfill (I-13) capable of quick compaction, the cost of said material to be included in the unit prices bid for Select Backfill (if and where directed) in the Bid Form. If no Select Backfill (if and where directed) bid item exists, the cost of said material to be included in the prices bid for the various bid items in the bid form.

D. The space between the pipe and the bottom and sides of the trench shall be backfilled by hand and thoroughly tamped with a light hand tamper, as fast as placed. The pipe shall then be covered by hand to a depth of at least one foot above the top of pipe.

E. The material may be machine backfilled with backfill continuing in lifts not to exceed 12 inches. Each lift shall be thoroughly compacted using mechanical tampers or other methods as approved by the Engineer. Contractor is hereby forewarned that he is responsible for any settlement of trench and excavation and the results thereof which may occur during the maintenance period following acceptance of the work.

F. During the backfill procedure, the soil compaction shall conform to not less than the following percentage of the maximum dry density:
   1. Structures & Building Areas - 95%
   2. Lawns & Unpaved Areas - 95%
   3. Pavement, driveways & walkway areas - 95%

G. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

H. Employ placement method that does not disturb or damage foundation perimeter drainage, and utilities in trench.

I. Maintain optimum moisture content of fill materials to attain required compaction density.

J. Do not leave more than 50 feet of trench open at end of working day.

K. Protect open trench to prevent danger to Owner.

3.9 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.10 FOUNDATIONS

A. Use every precaution in the excavation for the pipelines, manholes and other structures to protect the natural foundations upon which the work is to be built. Special care must be taken so as not to disturb the finished grade any more than is absolutely necessary. If and where required and directed by the Engineer, support the pipelines by concrete cradle in accordance with the general design and dimensions to be furnished by the Engineer or upon plank foundation.

3.11 PROTECTION OF FINISHED WORK

A. Reshape and recompact fills subjected to vehicular traffic during construction.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 312317

SECTION 312500- EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of temporary control measures ordered by the Engineer during the life of the contract and as shown on plans, to control erosion and sediment through use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses and other erosion control devices or methods.

B. The primary objective of this specification is to control soil erosion to the maximum extent practicable commensurate with reasonable and economical construction practices.

C. The temporary control provisions contained herein shall be coordinated with the permanent erosion control features (grass, pavement and other restorations) specified elsewhere in the contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period.

D. The erosion control measures described herein shall be continued until the construction is complete and final restorations installed.

E. Wherever construction exposes work, which is subject to erosion, the extent of such exposure in advance of the subsequent construction shall be subject to the approval of the Engineer. Erosion control features or other work to be completed within such areas shall follow as soon after exposure as practicable.

F. All materials and methods of construction shall be in accordance with the County / SCD District Standards for Soil Erosion and Sediment Control in which the project is located within.

G. In case of repeated failures on the part of the Contractor to control erosion, pollution, and/or siltation, the Owner reserves the right to employ outside assistance or to use his own forces to provide the necessary corrective measures. Such incurred costs will be charged to the Contractor.

H. Maintain SESC measures regardless of construction season or other times when the Project is closed down or suspended to ensure that the SESC measures function properly. Immediately correct or replace non-functioning SESC measures to meet the specified functionality.

I. When unstabilized areas caused by site development, grading, or other soil disturbing activities exist beyond 14 days, seed and mulch the disturbed areas. The Engineer may limit the size of unstabilized areas due to clearing, grubbing, grading, or other soil disturbing activities based on site conditions and the Contractor’s ability to install and maintain SESC measures.

J. Upon completion of soil disturbing activities, permanently stabilize disturbed areas within 7 days. If seasonal limitations preclude permanent stabilization, provide temporary SESC measures as approved by the Engineer.

1.2 SUMMARY

A. Section Includes:

1. Diversion channels.
2. Rock energy dissipator.
3. Paved energy dissipator.
4. Rock basin.
5. Rock barriers.
6. Sediment ponds.
7. Sediment traps.
8. Silt Fence
9. Tree Protection
10. Construction Entrance
11. Inlet Protection
12. Geotextile/matting

B. Related Sections:

1. Section 310513 - Soils for Earthwork.
2. Section 310516 - Aggregates for Earthwork.
3. Section 311000 - Site Clearing.
4. Section 312316 - Excavation.
5. Section 312323 - Fill.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:

1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:

1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Product Data: Submit data on joint filler, joint sealer, admixtures, and curing compounds geotextile.

C. Submit proposed mix design of each class of concrete for review prior to commencement of Work.

D. Test Reports: Indicate certified tests results for precast concrete at manufacturing facility, cast-in-place concrete in field, and granular backfill.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

1.5 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Preinstallation meeting.

B. Preconstruction Conference

Prior to the start of the applicable construction, the Contractor shall submit for acceptance his schedules for accomplishment of temporary and permanent erosion control work, as are applicable for excavation work, and any other elements of the project which may contribute to ground erosion of siltation. No work shall be started until the erosion control schedules and methods of operations have been accepted by the Engineer.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

B. Do not place grout when air temperature is below freezing.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 ROCK, RIP RAP AND STONE MATERIALS

A. Furnish materials according to standards of the Department of Transportation in which the project site is located within.

B. Rock: type; broken stone (irregular shaped rock); solid and nonfriable; six (6) or nine (9) in size.

C. Rip Rap: as defined by detail specific detail.

2.3 MULCHES, HAY FIBER MATS

A. Mulches may be hay, straw, fiber mats, netting, wood cellulose, corn or tobacco stalks, bark, corn cobs, wood chips, or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds and deleterious materials.

2.4 GRASS - TEMPORARY

A. Grass shall be a quick growing species (such as rye grass, Italian rye grass, or cereal grasses) suitable to the area providing a temporary cover.

2.5 FERTILIZER AND SOIL CONDITIONERS

A. Fertilizer and soil conditioners shall be of a standard commercial grade acceptable to the Engineer.

2.6 SILT FENCE

A. Fence posts shall be spaced 8 feet center-to-center or closer. They shall extend at least 2 feet into the ground. They shall extend 2 feet above ground.

B. A filter fabric, recommended for such use by the manufacturer, shall be buried at least 6 inches deep in the ground and then shall extend 6" parallel to grade. The filter fabric shall extend at least 2 feet above the ground. Filter fabric may be fastened in place by stake or other accepted means as specified by the district office.

C. The barrier shall be constructed so water cannot bypass the barrier around the ends.

D. Inspection shall be frequent and repair or replacement shall be made promptly as needed.

E. The barrier shall be removed when it has served its usefulness so as not to block or impede storm flow or drainage.

F. Install silt fence with geotextile buried securely in the existing soil. Join sections of the geotextile so that they work effectively as a continuous fence. The Contractor may install haybales instead of silt fence when approved by the Department.

G. Heavy-Duty Silt Fence. Install heavy-duty silt fence with geotextile securely buried in the existing soil. Join sections of the geotextile so that they work effectively as a continuous fence. Install fence posts at a slight angle toward the anticipated runoff source. Install the color of heavy-duty silt fence in locations as shown in the Plans. Do not substitute orange for black or black for orange.

2.7 HAYBALES

A. Embed haybales in the ground and place end to end to form a continuous line without gaps. Anchor haybales in place with wood stakes.

B. Haybale Check Dams With Temporary Stone Outlets. Embed haybales into the ground and anchor in place with wood stakes. Place temporary riprap in the center of each flow line. Place temporary No. 2 coarse aggregate immediately upgrade of each stone outlet. Place temporary riprap and No. 2 coarse aggregate on geotextile. When joining sections of geotextile, overlap the sections a minimum of 18 inches in the direction of flow.

2.8 TEMPORARY CONSTRUCTION ENTRANCE

A. Construct to minimize tracking of dirt and other materials onto existing roadways, provide a construction driveway at each location where vehicles exit the work site as approved by the Engineer. Construct driveways using No. 2 coarse aggregate placed on geotextile. Ensure that the construction entrance is at least 15 feet wide.

B. The Contractor may make driveways wider if approved by Engineer. Maintain the construction entrance by top dressing or by excavating and top dressing, as directed by the Engineer, with additional No. 2 coarse aggregate. When the driveway is no longer required, remove the driveway, backfill to the adjacent ground elevation, and restore the disturbed area to the original condition.

2.9 TEMPORARY STONE CHECK DAMS

A. Construct temporary stone check dams in ditches to reduce flow velocity.

B. Place No. 2 temporary coarse aggregate immediately upgrade of each check dam. Place temporary riprap and No. 2 coarse aggregate on the geotextile. When joining sections of the geotextile, overlap the sections a minimum of 18 inches in the direction of flow.

3.0 SEDIMENTATION POND

A. The Work in this Article includes a dam on prepared base including inlet riser pipe, anti-seep collar, key trench, outlet pipe and rock basin, and provisions for emergency spillway, all to indicated dimensions at indicated location.

B. Clear and grub storage area and embankment foundation area site as specified in Section 311000.

C. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.

D. Install pipe spillway, with anti-seep collar attached, at location indicated.

E. Place forms, and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as specified in Section 031000, and Section 032000. Construction of embankment and trench prior to placing pipe is not required.

F. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.

G. Construct rock basin at outlet end of pipe, as specified in this Section. Place embankment material, as specified in Section 312323. When required, obtain borrow excavation for formation of embankment, as specified in Section 312323.

H. On entire sedimentation pond area, apply soil supplements and sow seed as specified in Section 329113 and Section 329219.

I. Furnish materials according to standards of the Department of Transportation in which the project site is located within.

3.1 SEDIMENT TRAPS

A. The construction in this Article is a basic sediment trap of indicated dimensions including large coarse aggregate or rock dam with an upslope lesser-size coarse aggregate filter blanket, and geotextile material at the upslope juncture of dam and finished ground.

B. Clear site, as specified in Section 311000.

C. Construct trap by excavating and forming embankments as specified in Section 312316, and Section 312323.

D. Place coarse aggregate or rock at outlet as indicated on Drawings.

E. Place geotextile fabric, as specified for rock energy dissipator.

F. When required, obtain borrow excavation for formation of embankment, as specified in Section 312316.

G. Furnish materials according to standards of the Department of Transportation in which the project site is located within.

3.2 DIVERSION CHANNELS

A. The construction in this Article is for a vegetated channel at the indicated locations, to divert surface run-off and avoid excessive concentrated sheet flow.

B. Windrow excavated material on low side of channel.

C. Compact to 95 percent maximum density.

D. Install Work according to standards of the New Jersey Department of Transportation

3.3 INLET PROTECTION

Inlet Filters. Provide Type 1 and Type 2 inlet filters as follows:

Type 1

A. For a new inlet structure without casting, mold welded steel wire fabric around the inlet walls. Extend the welded steel wire a minimum of 6 inches down each side of the structure. Secure geotextile to the welded wire fabric. Place No. 2 coarse aggregate against the inlet structure to hold the inlet filter in place.

B. For an inlet structure with a casting and exposed exterior wall, place geotextile under the casting and extend it a minimum of 6 inches below the top of the exposed walls. Place No. 2 coarse aggregate around the drain hole opening.

C. For an existing inlet structure without exposed exterior walls, place geotextile under the grate and extend the geotextile for a minimum of 6 inches beyond the grate.

D. For an inlet with a curb piece and without exposed exterior walls, ensure that the opening in the curb piece has a height of 2 inches. If the opening is greater than 2 inches, achieve the 2 inch opening size by wrapping the geotextile around an appropriately sized piece of lumber. Place the lumber against the vertical opening.

Type 2

A. Remove the inlet grate and place the inlet filter in the opening, holding out approximately 6 inches of the filter outside the frame. Replace the inlet grate to hold the filter in place. Empty the filter according to the manufacturer’s recommendations.

B. When removing the filter, ensure that sediment does not enter into the drainage system. Clean out the filter, dispose of the sediment as specified in 202.03.03.C.2, rinse and return the filter to its original shape, and replace the filter inside the inlet.

3.4 TEMPORARY INLET SEDIMENT TRAPS

A. Construct temporary inlet sediment traps when the elevation of the surface runoff is lower than the inlet structure. Create a 6 inch diameter opening in the inlet and place a 3 × 3

foot piece of Type 1 inlet geotextile and No. 2 coarse aggregate over the opening to prevent sediment from entering the inlet. Place temporary inlet sediment traps in each flow line upgrade of the inlet structure.

B. Before raising the elevation of the surface runoff, remove and dispose of the temporary inlet sediment trap and repair the opening in the inlet.

3.5 TEMPORARY STONE OUTLET SEDIMENT TRAPS

A. Construct temporary stone outlet sediment traps with temporary basins and riprap spillways, within existing, new, and temporary ditches.

B. Place No. 2 coarse aggregate immediately upgrade of the spillways.

C. Place the riprap stones and coarse aggregate on geotextile that is anchored in the soil. If sections of geotextile need to be joined, overlap the sections a minimum of 18 inches in the direction of flow.

3.6 TREE PROTECTION

A. Before start of construction operations, install tree protection by surrounding trees and other vegetation with vegetation canopy.

B. Do not park vehicles or equipment, or store materials within the area of tree protection.

C. In situations where tree protection conflicts with excavation or other construction, request permission to modify tree protection and provide a protection plan for approval by the Department.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting Work.

B. Verify compacted subgrade and/or granular base and/or stabilized soil is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other Work are correct.

3.2 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements and 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Compaction Testing: As specified in Section 312323.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.4 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

C. Do not damage structure or device during cleaning operations.

D. Do not permit sediment to erode into construction or site areas or natural waterways.

E. Clean channels when depth of sediment reaches approximately one-half channel depth.

F. Employ construction methods to minimize airborne dust and prevent soils and other materials from being deposited on existing roadways. Apply water or other Engineer approved materials to unpaved areas to control dust caused by hauling or other construction operations.

G. Contractor shall have onsite a water street cleaner during warmer months and water sweep cleaning shall be completed daily.

H. Construction Entrances shall be maintained. Upon tracking of materials offsite, Contractor shall replenish construction entrance material to the satisfaction of the Engineer.

3.5 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

C. Protect paving from elements, flowing water, or other disturbance until curing is completed.

3.6 RESPONSIBILITIES:

A. Contractor is responsible for adherence to all SESC measures in accordance with local SCD Office and the NJDOT.

B. The Contractor will be responsible for maintaining all soil erosion and sediment control measures in an acceptable manner. All temporary measures shall be removed by the Contractor as directed by the Engineer.

C. Remove temporary SESC measures when necessary to allow for the installation of permanent measures, or as permanent measures become functional.

D. Notify the Engineer 10 days before removing temporary SESC measures.

E. Between Substantial Completion and Completion, remove temporary SESC measures unless the Engineer directs that specific Items remain in place.

F. Contractor is responsible for the coordination with the local SCD office to receive final inspection and sign off for the project. Submission of the final SCD Office approval is a condition of final payment.

PART 4 - QUANTITY AND PAYMENT

4.1 Quantity and Payment

A. Except for items listed in the proposal section, all costs for Temporary Soil Erosion and Sediment Control Measures shall be included in the specific line items included in the rebid form.

B. In case of repeated failures on the part of the Contractor to control erosion, pollution, and/or siltation, the Owner reserves the right to employ outside assistance or to use his own forces to provide the necessary corrective measures. Such incurred costs will be charged to the Contractor.

END OF SECTION 312500

SECTION 321216 - ASPHALT PAVING

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.

B. Bituminous stabilized base course and surface course shall be constructed to the full depth and width and to the lines and grades shown on the drawings.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Cold milling of existing asphalt pavement.
4. Hot-mix asphalt patching.

B. Related Requirements:
1. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
2. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference prior to contractor mobilizing to the project location. Engineer to coordinate with owner, contractor, other utilities, and funding agency (if applicable).

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 SUBMITTALS

A. Hot-Mix Asphalt Designs:

1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.
2. For each hot-mix asphalt design proposed for the Work.
    a. HMA Base Course, Mix 19M64
    b. HMA Surface Course, Mix 9.5M64

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer and testing agency.

B. Material Certificates:

1. Aggregates.
2. Asphalt binder.
3. Asphalt cement.
4. Tack coat.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the New Jersey Department of Transportation.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of New Jersey Department of Transportation.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
1. Tack Coat: Minimum surface temperature of 32 deg F.
2. Slurry Coat: Comply with weather limitations in ASTM D3910.
3. Asphalt Base Course and Binder Course: Minimum surface temperature of 32 deg F and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 32 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation PG 58-28 PG 64-22 or PG 70-22.

B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material and ASTM D946/D946M for penetration-graded material.

C. Emulsified Asphalt Prime Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.

C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D6690, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

1. Surface Course Limit: Recycled content no more than [**15**] percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by the Department of Transportation in which the project is constructed in and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: 19M64 (New Jersey).
3. Binder Course: (If & Where Directed)
4. Surface Course:
    a. 9.5M64 Municipal Roadways.
    b. 12.5M64 County Roadways.

C. Emulsified-Asphalt Slurry: ASTM D3910, Type 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 18-wheel, tandem-axle dump truck weighing not less than 22 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.

7. Handle milled asphalt material in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 2 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 INSTALLATION OF PAVING GEOTEXTILE

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.

B. Place paving geotextile promptly in accordance with manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.8 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide or as indicated on the plans unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.10 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread hot-mix asphalt at a minimum temperature of 250 deg F.

1. Hot-Mix Asphalt: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.12 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.13 SURFACE TREATMENTS

A. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage (if required) a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.15 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

PART 4 - QUANTITY AND PAYMENT

4.1 Payment for this item shall be included in the lump sum cost under the line item “FINAL SITE RESTORATION AND LANDSCAPING, COMPLETE” as listed in the bid form. Such price shall include but not limited to: grading, site improvements, tree and plant protection, landscaping, site restoration, concrete and asphalt paving such as driveway extension and restoration, concrete driveway apron and concrete curb, chain link fences and gates, clean up and waste disposal and all other work in connection therewith or incidental thereto.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the restoration of the following concrete paving disturbed during construction:
   1. Vertical and depressed curbs and gutters.
   2. Sidewalks.

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference prior to contractor mobilizing to the project location. Engineer to coordinate with owner, contractor, other utilities, and funding agency (if applicable).

   1. Review methods and procedures related to concrete paving, including but not limited to, the following:

      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.

   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

      a. Contractor's superintendent.
      b. Concrete paving Subcontractor.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

B. Concrete:

1. For 6”x9”x 18” concrete curb developing a compressive strength of 4,000 psi at twenty-eight (28) days).
2. For 9”x20” white concrete curb use concrete developing a compressive strength of 4,500 psi at twenty-eight (28) days.
3. Use air-entrained concrete.

C. Cement aggregates, water and air-entrainment methods and materials for concrete curb: Section 607 of the NJDOT Standard Specifications.

D. Joint Filler: Bituminous cellular type, conforming to Section 914.01 of the NJDOT Standard Specifications. ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.

E. Curing Compound: White pigmented liquid, conforming to Section 903.10 of the NJDOT Standard Specifications.

F. Bituminous Paving: Shall conform to the materials specified in Section 02320 and 02330.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, gray portland cement Type II.
2. Fly Ash: ASTM C618, Class C.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water: Potable and complying with ASTM C94/C94M.

2.4 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content, 3/4-inch Nominal Maximum Aggregate Size: 5 percent plus or minus 1-1/2 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.

2.5 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Reference standards included in this Specification section: New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction, 1983 (Standard Specifications):

1. Section 405: Concrete Surface Course
2. Section 607: Curbs and Headers
3. Section 903.10: Curing Materials for Concrete
4. Section 914.01: Joint Fillers, Preformed.

B. Submittals:

1. CERTIFICATES: All deliveries of concrete shall be accompanied by delivery slips, copies of which shall be provided to the Engineer by the Contractor.

C. Environmental Requirements:
1. Allowable concrete temperatures:
   a. Cold weather: 60 degrees F. when discharged from the mixer.
   b. Hot weather: Maximum concrete temperature is 80°F.
2. Do not place concrete during rain, when atmospheric temperature is at or below 36° F. (36° F), or when conditions are otherwise unfavorable as determined by the Engineer.

D. Protection:
1. When directed by Engineer, protect new concrete curb from traffic for a minimum of seven (7) days.
2. Method of protection shall be approved by the Engineer prior to beginning work under this Section.

E. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

F. Proof-roll prepared subbase surface below concrete roadway paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a pneumatic-tired and loaded, 18-wheel, tandem-axle dump truck weighing not less than 22 tons.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. When encountered, cut existing pavements vertically with a sharp tool on a straight line prior to excavating for curb. Cut hall be made six inches (6") beyond the limits of excavation, and maintained straight and neat, or recut and dressed as directed by the Engineer.

C. Excavate subgrade and set forms so that finished curb conforms to required lines and grades.

D. Prepare curb subgrade as specified in Section 607.03 of the NJDOT Standard Specifications.

E. Verify that earthwork is completed to correct line and grade.

F. Verify that forms conform to proposed line, grade and curb cross section.

G. Check that subgrade is smooth, compacted and free of frost or excessive moisture.

H. Do not commence work until conditions are satisfactory.

I. Joints:
1. No new joints shall be installed within five feet of existing joint.
2. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
3. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
6. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete paving.
7. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.3 CONCRETE PLACEMENT

Before placing concrete, inspect and complete formwork installation, steel reinforcement (if required), and items to be embedded or cast-in.

A. Remove snow, ice, or frost from subbase surface and steel reinforcement (if required) before placing concrete. Do not place concrete on frozen surfaces.

B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

D. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

E. Consolidate concrete according to ACI 301 by mechanical vibrating equipment (if specified) supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

F. Screed paving surface with a straightedge and strike off.

G. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.4 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.

3.5 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.6 PERFORMANCE

A. Method of curb construction shall conform to Section 607, respectively, of the NJDOT Standard Specifications, except as otherwise modified by this Specification section:
   1. Install 1/2 inch wide expansion joints at equal intervals, not to exceed twenty feet (20'). Install additional expansion joints where curb abuts sidewalk or other structures. Fill expansion joints with joint filler, 1/2 inch thick. Insert joint filler 1/4 inch from the top and face of curb.
   2. Construct contraction joints midway between expansion joints.
      Finish concrete surface of curb to match existing adjacent curbs. Curb cross section shall match the existing curb.

PART 4 - QUANTITY AND PAYMENT

4.1 Payment for this item shall be included in the lump sum cost under the line item "FINAL SITE RESTORATION AND LANDSCAPING, COMPLETE" as listed in the bid form. Such price shall include but not limited to: grading, site improvements, tree and plant protection, landscaping, site restoration, concrete and asphalt paving such as driveway extension and restoration, concrete driveway apron and concrete curb, chain link fences and gates, clean up and waste disposal and all other work in connection therewith or incidental thereto.

END OF SECTION 321313

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts and center drop for gates.
4. Manual gates and related hardware.
5. Privacy slats.

1.2 REFERENCES

A. ASTM International:

1. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
6. ASTM A817 - Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
7. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
8. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
9. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
10. ASTM F552 - Standard Terminology relating to Chain Link Fencing.
11. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
12. ASTM F626 - Standard Specification for Fence Fittings.
13. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
14. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
15. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
16. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
17. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
18. ASTM F1183 - Standard Specification for Aluminum Alloy Chain Link Fence Fabric.

19. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.
20. ASTM F1345 - Standard Specification for Zinc - 5% Aluminum -Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric.

B. Chain Link Fence Manufacturers Institute:

1. CLFMI - Product Manual.

1.3 SYSTEM DESCRIPTION

A. Fence Height: six feet (6) feet high above grade when erected.

B. Line Post Spacing: At intervals not exceeding 10 feet.

C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

D. Samples: Submit two samples of fence fabric, illustrating construction and colored finish.

E. Manufacturer's Installation Instructions: Submit installation requirements, post foundation anchor bolt templates.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify source and origin for salvaged and reused products.
b. Certify recycled material content for recycled content products.
c. Certify source for regional materials and distance from Project site.

B. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Salvaged, refurbished, and reused products.
b. Products with recycled material content.

c. Regional products.

1.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

C. Operation and Maintenance Data: Procedures for submittals.

1.7 QUALITY ASSURANCE

A. Supply material according to CLFMI - Product Manual.

B. Perform installation according to ASTM F567.

C. Perform Work according to the State of New Jersey (NJ) Municipality of Pennsauken Public Works standards.

D. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

1.9 DELIVERY, STORAGE AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Allied Tube & Conduit; Atkore International.
2. Amico Corporation.
3. Master Halco.
4. Pacific Fence and Wire Company.
5. Anchor Fence, of Baltimore, Maryland Inc. or equal.
6. Substitutions: Section 016000 - Product Requirements.

2.2 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site

2.3 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to CLFMI Product Manual.

B. Fabric Size: CLFMI Light Industrial, Standard Residential service.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.4 MATERIALS

A. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25 Ksi; vinyl coating conforming to ASTM F1043 Type A on pipe exterior and interior. Coating shall be 10-14 mils applied by fusion bonding.
1. End, corner and pull posts shall be of square shape. For a fabric height of 6'-0" and less the square post shall have an outside diameter of 2"; for a fabric height of over 6'-0", the square post shall have an outside diameter of 2.5 inches.
2. Rails and post braces shall have an outside diameter of 1.66 inches.
3. Intermediate posts shall be a "C" section. The "C" section shall be manufactured from 45,000 psi steel having a thickness of 0.121", galvanized coating, 2 oz. per sq. ft. inside; 2 oz. per sq. ft. outside (total of 4.0 oz.) per ASTM 525.
    a. For a fabric height of 6'-0" and less, the "C" section shall have an outside diameter of 1.875" x 1.625" with a weight of 2.30 pounds per foot. For a fabric height of over 6'-0" the "C" section shall have an outside diameter of 2.25" x 1.70" with a weight of 2.70 pounds per foot.
4. All posts shall be of sufficient length to provide 36-inch setting in concrete footings. Each post shall have a post top so designed as to exclude moisture from the post.

B. Fabric Wire: [ASTM A121 Coating Type Z, galvanized steel]; 9 gage thick wire, 4 strands, 4 points at 3 inchoc. The core wire shall be 9 gauge a diameter of 0.148" and a breakload of 1290 pounds woven into a two-inch mesh. The steel core wire shall be galvanized in accordance with ASTM A-641-71A. The color shall be selected by the Owner.

C. Concrete: Type specified in Section 033000.

2.5 COMPONENTS

A. Line Posts: 2.38-inchdiameter.

B. Corner and Terminal Posts: 2.38 inch.

C. Gate Posts: 4.5diameter.

D. Rails and Braces

1. Top and middle Rail: 1.66-inch diameter, plain end, sleeve coupled.
    a. Top rail shall have a continuous 1-5/8" O.D. top rail. The top rail shall pass through openings provided in the line post top. Each length shall be coupled with an outside sleeve, 6" long. The chain link fabric shall be attached to the top rail by means of a 13 (.091") gauge vinyl coated tie wire, double wrapped, at intervals of approximately 24".
    b. Middle rail shall be as the top rail specified above. In lieu of a bottom rail, a 6-gauge vinyl coated tension wire shall be provided along the bottom of the fence line. The fabric shall be attached to the tension wire at intervals of 24" with vinyl coated hog rings.
2. Truss Braces - Fences with fabric 6' high and over shall be provided with a brace rail of 1-5/8"O.D. between each terminal post and the next adjacent line post. Each brace rail shall have attachments for a 5/16" vinyl coated truss rod and turnbuckle attachment. Truss rods may be eliminated in any line of fence where there is a continuous center rail.

E. Gate Frame: 1.66-inch diameter for fittings and truss rod fabrication. Gate frames shall be constructed of 2" square galvanized members weighing 2.60 lbs./LF or 2" square aluminum members, alloy 6063-T6, weighing .94 lbs./LF. All frames shall be welded to form a rigid panel. Internal bracing, when required, shall be 1-1/4" square.

F. Fabric: 2-inch diamond mesh interwoven wire, 6 gage thick, top salvage twisted tight, bottom selvage twisted tight. The fabric shall be attached to the frame on all four sides by means of hook bolts and tension rods. When barbed wire is required, vertical extensions shall be installed one foot above the gate frame to accommodate 3 strands of barbed wire.

G. Tension Wire: 6 gage thick steel, single strand, marcelled, spiraled or crimped, aluminum-coated tension wire conforming to ASTM A824. Fabric shall be held in place at all terminal posts by means of a fiberglass tension bar not less than 3/16" x 3/4" and not less than 2" shorter than the fabric height. The tension bar shall be attached to the square posts by means of clips at intervals not to exceed 15".

H. Tie Wire: Aluminum alloy steel wire.

2.6 ACCESSORIES

A. Caps: Galvanized pressed steel; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners, and fittings; galvanized steel.

C. Extension Arms: Galvanized pressed steel, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

D. Gate Hardware: Fork latch with gravity drop and a center gate stop and drop rod; two 90-degree gate hinges for each leaf [and hardware for padlock keyed to match hardware specified in Section 087100.

2.7 GATES

A. General:

1. All gates shall be equipped with galvanized steel hinges and latch. All gates to be equipped with a positive type latching device with provisions for padlocking. All drive gates to be provided with center plunger rod, catch and semi-automatic outer catches to secure gates in open position. Each gate shall be provided with stock solid bronze lock as manufactured by Yale and Towne or equal. Fasten lock to gate with brass chain. Locks shall be master keyed to Owner's other locks
2. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
3. Factory assemble gates.
4. Conform to requirements specified for PVC coated steel chain link fence except that PVC coated aluminum alloy framing conforming to ASTM B429/B429M may be used.
5. Design gates for operation by one person.
6.

B. Swing Gates:

1. Fabricate gates to permit 180-degree swing.
2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.
3. Posts for swing gates shall be as follows:

Gate Leaf Single Width	Post Sizes
6' & less	2-1/2" sq. tubing
6' - 12'	4" OD Sch. 40
12' - 19'	6-5/8" OD Sch. 40
19' - 23'	8-5/8" OD Sch. 40
23' - 30'	10-3/4" OD Sch. 40

Each post shall be of sufficient length to allow for a depth of approximately 3' below ground level.

C. Sliding Gates:

1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.
2. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.
3. Secure rollers to post or frame without welding.

D. Cantilever Sliding Gates:

1. Fabricate gate leaf frames and tracks of aluminum conforming to ASTM B429/B429M alloy 6063-T6 or as required to meet performance requirements of ASTM F1184.
2. Frame Members: Minimum 2 inches at 0.91 lb/ft aluminum tubing alloy 6063-T6, weighing 0.94 pounds per lineal foot and shall be welded assembly forming rigid, one-piece unit.
3. Install fabric securely stretched and held on all four sides in the 2" square tubing by use of hook bolts and tension rods. Fabric filler shall match fence. Brace cantilever overhang frames with 3/8 inch brace rods. For gate leaf sizes greater than 23 feet, fabricate with additional lateral support rail welded adjacent to top and bottom horizontal rails.
4. Provide minimum overhang for each leaf opening size as follows:

    a. Up to 10'-0"Overhang: 6'-6".
    b. 10'-0" to 14'-0" Overhang: 7'-6"
    c. 14'-1" to 22'-0"Overhang: 10'-0".
    d. 22'-1" to 30'-0"Overhang: 12'-0".
    e. 31'-0" to 35'-0" Overhang: 13'-6"..
    f. 36'-0" to 40'-0" Overhang: 16'-0".
    g.
5. Track: Combined, integral track and rail. The dual enclosed track shall consist of a two track and rail combination aluminum extrusion, weighing 3.72 pounds per foot each with a combined weight of 7.44 pounds per foot, welded into a single top member unit. Each track shall have a 2,000-pound reaction load.
6. Rail: Aluminum extrusion; The bottom rail shall be 2" x 4" aluminum tubing minimum total weight of 1.71 lb/ft; designed to withstand reaction load of 2,000 lbs.
7. Roller Track Assembly: Two swivel type, zinc, die cast trucks having four, sealed lubricant ball bearing wheels minimum 2 inches diameter by 9/16 inches width designed for same reaction load as rail. Provide two side-rolling wheels for each gate leaf to maintain alignment of truck in track.
8. Fasten trucks to post brackets by minimum 7/8-inchdiameter, 1/2-inchshank ball bolts.
9. Provide galvanized steel guide wheel assemblies consisting of two rubber wheels of minimum 4-inch diameter with oil-impregnated bearings for each supporting post.
10. All gate hangers, latches, brackets, guide assemblies and stops shall be galvanized after fabrication malleable iron or steel. A positive latch shall be provided with provisions for padlocking.
11. Gates and gate posts shall be coated by the thermal fusion process with PVC, 10 to 15 mils thick to match the fence.
12. Gates shall be installed on 4" OD Schedule 40 galvanized posts weighing 9.1 pounds per foot. Two double and one latch post to be used for single slide gates and four double posts for double slide gates.
13. Attach guide wheel assembly to post so bottom horizontal member rolls between wheels and permitting adjustment to maintain plumb gate frames and proper alignment.
14. All gates shall be equipped with galvanized steel hinges and latch. All gates to be equipped with a positive type-latching device with provisions for padlocking. All drive gates to be provided with center plunger rod, catch and semi-automatic outer catches to

secure gates in opened position. Each gate shall be provided with stock solid bronze lock as manufactured by Yale and Towne. Fasten lock to gate with brass chain. Locks shall be master keyed to Owners other locks.

2.8 PRIVACY SLATS

A. Privacy Slats: Vinyl strips, flat configuration, sized to fit fence fabric, black color as selected.

2.9 FINISHES

A. Components and Fabric: Vinyl coating, black color according to ASTM F934 as selected.

B. Vinyl Components: color to match fabric as selected.

C. Hardware: Galvanized to ASTM A153/A153M,2.0 oz/sq ft coating.

D. Accessories: Same finish as framing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories and gates according to ASTM F567.

B. Set intermediate, terminal, gate, and posts plumb, in concrete footings with top of footing 6 inches below finish grade. Slope top of concrete for water runoff.

C. Line Post Footing Depth Below Finish Grade: ASTM F567 0.5 feet

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567 0.5 feet

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

F. Install top rail through line post tops and splice with 6-inchlong rail sleeves.

G. Install center and bottom brace rail on corner gate leaves.

H. Place fabric on inside of posts and rails.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Install support arms sloped outward and attach barbed wire; tension and secure.

P. Support gates from gate posts. Do not attach hinged side of gate from building wall.

Q. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf, latch, catches, drop bolt, foot bolts and sockets, torsion spring retainer, and retainer and locking clamp.

R. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

S. Connect to existing fence at existing terminal post.

T. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

U. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.

V. Reuse holes resulting from removal of existing post footings for installation of new posts.

W. Center and align posts. Place concrete around posts and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

X. Extend concrete footings 1 inches above grade, and trowel, forming crown to shed water.

Y. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts.

3.2 ERECTION TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

3.3 SCHEDULES

A. Property Perimeter: 6 feet high, dark green fabric, privacy slats.

B. Fencing at Transformer: 8 feet high, aluminized coated fabric, single strand barbed wire top, on 45-degree sloped arms, pointing out.

PART 4 - QUANTITY AND PAYMENT

4.1 Payment for this item shall be included in the lump sum cost under the line item “FINAL SITE RESTORATION AND LANDSCAPING, COMPLETE” as listed in the bid form. Such price shall include but not limited to: grading, site improvements, tree and plant protection, landscaping, site restoration, concrete and asphalt paving such as driveway extension and restoration, concrete driveway apron and concrete curb, chain link fences and gates, clean up and waste disposal and all other work in connection therewith or incidental thereto.

END OF SECTION 323113

SECTION 329119 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Final grade topsoil for finish landscaping.

B. Related Sections:

1. Section 310513 – Soils for Earthwork
2. Section 312213 - Rough Grading: Site contouring.
3. Section 312317 – Trenching Excavation and backfill
4. Section 312323 - Fill: Backfilling at building areas.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Topsoil:
1. Basis of Payment: Includes excavating existing topsoil, supplying topsoil materials, stockpiling, preparing and scarifying substrate surface, placing where required, and rolling.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures

A. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill and topsoil to testing laboratory.

B. Materials Source: Submit name of imported materials source.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates: For the source and origin for subsoil and topsoil materials.

B. Product Certificates: For the source for regional subsoil and topsoil materials and distance from Project Site.

1.5 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. Perform Work in accordance with the State of New Jersey and Municipality of Pennsauken standard.

C. Maintain one copy on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.List materials specified in this section required to be regional materials.

2.2 MATERIAL

A. Topsoil: Fill Type S2 as specified in Section 310513.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify building and trench backfilling have been inspected.

B. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Certify source for regional materials and distance from Project site.

B. Eliminate uneven areas and low spots.

C. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove contaminated subsoil.

D. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, planting, is required. to thickness as scheduled. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material, building, to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

H. Preparation of Lawn Work:

1. All areas designed for lawn shall be clean and free of all weeds and debris. Any debris greater than 1-1/2" in diameter, such as stones, sticks and construction waste material, shall be removed after tilling and discing so as to leave the surface smooth, even and free of roots.
2. It shall be the responsibility of the contractor to see that all areas designated for lawn have a minimum of 4" of topsoil. Any areas not meeting this requirement will be brought up to minimum standards by the contractor before proceeding with the work.
3. The subgrade must be loosened to a depth of 4". All debris over 1-1/2" in diameter brought to the surface by this operation shall be removed before proceeding with the spreading of the topsoil. No heavy equipment will be permitted on the lawn area after this work has been done.
4. If compacted, those areas which already have the required 4" minimum of topsoil shall be loosened to the 4" depth. Any debris 1-1/2" in diameter or over, brought to the surface by this operation, shall be removed.
5. Soil Improvements: Upon all areas for lawn, apply agricultural limestone uniformly with a mechanical spreader at the rate of 50 lbs. per 1000 sq.ft. Incorporate these elements into the 4" of topsoil. Then apply complete 10-6-4 fertilizer at the rate of 20 lbs. per 1000 sq.ft. Take the entire area lightly before sodding and seeding.

I. Hydro-Seeding:

1. Hydro-seeding will be an accepted method of seeding grass and crownvetch seed and may be used in lieu of seeding by other mechanical methods.
2. Prepare area to be seeded as described above for seeding and sodding.
3. Immediately following seeding, apply mulch to a thickness of 1/8". Maintain clearance from shrubs and trees.
4. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4" below soil level.

5. Combine seed, mulch, binder, with water in seeder tank and apply at the following rates:

Material	Rate of Application
Seed	As specified.
Mulch	1500 lbs. per acre.
Binder	According to manufacturer's recommendations.

6. Hydro-seed solution shall be applied in such a manner so as to provide an even coverage of seed on lawn areas.

J. Seeding (Lawn Areas):

1. Immediately before any seed is to be sown, the ground shall be scarified four (4) inches deep and shall be raked until the surface is smooth, friable and or a uniformly fine texture.
2. Lawn areas shall be seeded evenly with a mechanical spreader, at the rate of four (4) pounds per 1000 sq.ft. The total amount of seed required for the area shall be divided in half, with 1/2 of the amount required spread in one direction and the other half spread at right angles to this.
3. Lightly rake the seed in (not more than 1/8" deep), roll with a roller and water with a fine spray.
4. If needed, all new lawn areas shall be mulched with salt hay after seeding, at the rate of one (1) bale of salt hay to 2,000 sq.ft. lawn area. Use an approved binder at manufacturer's directions. Keep the area moist until established.
5. The contractor shall not supply water or any additional maintenance until such time as the lawn area is established to the satisfaction of the Engineer.
6. Identify seeded areas with stakes and string around areas periphery. Set string height to six (6) inches. Space stakes at 48" (forty-eight inches).
7. Cover seeded slopes where grade is four (4) inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
8. Lay fabric smoothly on surface, bury top end of each section in six (6) inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
9. Secure outside edges and overlaps at 36" (thirty-six inch) intervals with stakes.
10. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging and location of packaging.
11. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual.
12. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
13. Scarify subsoil to a depth of three (3) inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
14. Grade to eliminate rough, low or soft areas, and to ensure positive drainage.
15. Install edging at periphery of seeded areas in straight lines to consistent depth.
16. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
17. At sides of ditches, fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

K. Fertilizing:

1. Apply fertilizer in accordance with manufacturer's instructions.
2. Apply after smooth raking of topsoil and prior to roller compaction.
3. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
4. Mix thoroughly into upper two (2) inches of topsoil.
5. Lightly water to aid the dissipation of fertilizer.
6. Deliver fertilizer in waterproof bags showing weight, chemical analysis and name of manufacturer.
7. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content and pH value.
8. Testing is not required if recent tests are available for imported topsoil. Submit these test results to Engineer for approval. Indicate, by test results, information necessary to determine suitability.

3.5 GUARANTEE, MAINTENANCE, REPLACEMENT AND ACCEPTANCE:

A. Lawn Work:

The contractor shall be responsible for the proper care of the lawn areas from the moment at which they are installed and continuing through the guarantee period. Washouts, gullies, areas that do not germinate, dead sod areas, or other areas not up to the acceptable standards, shall be repaired immediately or at such times as directed by the Engineer throughout the guarantee period. Watering shall be the responsibility of the contractor for at least two (2) weeks, the cost of which is to be included in the bid price.

1. At the conclusion of the guarantee period, all lawn areas shall be covered with a reasonable stand of grasses specified to be planted and acceptable to the Engineer. All areas not accepted shall be repaired and re-seeded in the manner with the seed specified in these specifications. These areas must be then maintained as outlined above for the final acceptance.
2. Recondition existing lawn areas damaged by Contractor's operations including storage of materials or equipment and movement of vehicles. Also, recondition existing lawn areas where minor regrading is required.
3. Recondition other existing lawn areas where indicated.
4. Provide fertilizer, seed or sod and soil amendments as specified for new lawns and as required to provide a satisfactory reconditioned lawn. Provide a new planting soil as required to fill low spots and meet new finish grades.
5. Cultivate bare and compacted area thoroughly to provide a good, deep planting bed.
6. Remove diseased or unsatisfactory lawn areas; do not bury them in soil. Remove topsoil containing foreign material.
7. Where substantial lawn remains (but is thin), mow, rake, aerate is compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers as required. Apply a seed bed mulch, if required, to maintain moist conditions.
8. Water newly planted area and keep moist until new grass is established.

B. Maintenance

1. Mow grass at regular intervals to maintain a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at anyone mowing.
2. Neatly trim edges and hand clip where necessary.

3. Immediately remove clippings after mowing and trimming.
4. Water to prevent grass and soil from drying out.
5. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
6. Immediately replace sod and/or re-seed areas which show deterioration or bare spots.
7. Protect sodded and/or seeded areas with warning signs during maintenance period.

C. Include maintenance instructions, cutting method and maximum grass height, types, application frequency and recommended coverage of fertilizer

3.6 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.

a. Grade Site surface to prevent freestanding surface water.

2. Leave unused materials in neat, compact stockpile.

3.7 TOLERANCES

A. Top of Topsoil: Plus or minus 1/2 inch.

3.8 PROTECTION OF INSTALLED WORK

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

3.9 SCHEDULES

A. Compacted topsoil thicknesses:

1. Seeded Grass: 6 inches.
2. Sod: 4 inches.
3. Shrub Beds: 18 inches.
4. Flower Beds: 12 inches.
5. Planter Boxes: To within 3 inches of box rim.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

4.1 All costs for Landscape Grading shall be included under the line idem “FINAL SITE RESTORATION AND LANDSCAPING, COMPETE” as listed in the bid form. Such price shall include but not limited to: grading, site improvements, tree and plant protection,

landscaping, site restoration, concrete and asphalt paving such as driveway extension and restoration, concrete driveway apron and concrete curb, chain link fences and gates, clean up and waste disposal and all other work in connection therewith or incidental thereto.

END OF SECTION 329119

SECTION 330110.58 - DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Disinfection chemicals.

B. Related Requirements:

1. Section 331416 "Site Water Utility Distribution Piping" for product and execution requirements for installation and testing of site domestic water distribution piping.

1.2 SUBMITTALS

A. Disinfection Procedure:

1. Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.

B. Product Data: Submit manufacturer information for proposed chemicals and treatment doses.

C. Certify that final water complies with disinfectant quality standards of NJDEP.

D. Material Test Reports: For each disinfectant, by a qualified testing agency.

E. Field Quality-Control Reports: For disinfection chemicals.

F. Qualifications Statements: For manufacturer and applicator.

1.3 CLOSEOUT SUBMITTALS

A. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant start and completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicators Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. Applicable state and local standards and regulations.

2.2 DISINFECTION CHEMICALS

A. Chemicals:

1. Hypochlorite: Comply with AWWA B300.

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. Verify that piping system has been cleaned, inspected, and pressure tested.

C. Verify that access fittings have been installed under Section 331416 "Site Water Utility Distribution Piping."

D. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DISINFECTION CHEMICALS

A. All new water mains shall be sterilized in accordance with AWWA C651 latest revision. Water main sterilization shall be accomplished by the use of calcium hypochlorite tablets, HTH as manufactured by Mathieson Alkali Works or approved equal.

B. The Contractor is required to follow all methods outlined in Section 4 of AWWA C651 latest revision for the prevention of contamination in the water mains.

C. During construction, 5-gram calcium hypochlorite tablets shall be placed in each section of pipe in accordance with the following table:

NUMBER OF 5-G CALCIUM HYPOCHLORITE TABLETS REQUIRED FOR DOSE OF 25mg/L*

	Length in Pipe Section (ft)				
Pipe Diameter In.	13 or less	18	20	30	40
	Number of 5-G Calcium Hypochlorite Tablets				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

Based on 3.25 g available chlorine per tablet; any portion of tablet rounded to next higher number

D. One tablet shall be installed in each hydrant, hydrant branch, and other appurtenance.

E. The required number of tablets should be fastened to the top of each length of pipe as it is laid using hot tar or "Permatex No. 2" gasket cement as the adhesive. Care should be taken to see that the adhesive only covers the side of each tablet so that as much surface as possible is exposed to the water when it is introduced into the main.

F. The mains shall be filled in accordance with Section 5.1.3 of AWWA C651-86. Water shall be added at a rate such that the flow shall not exceed a velocity no greater than 1 ft/s, completely removing all air voids. The treated water shall remain in the mains for a minimum of 24 hours.

G. Following the chlorination period, the Contractor shall flush the main of the heavily chlorinated water in accordance with Section 6.1 of the AWWA specifications. Disposal of the heavily chlorinated water shall be in accordance with Section 6.1 and shall meet all Federal, State, and Local requirements.

H. Alternate methods of sterilization as outlined in AWWA C651-86 shall be permitted only with prior approval of the Engineer.

3.3 FIELD QUALITY CONTROL

A. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation according to AWWA C651.
2. Use of liquid chlorine is not permitted.
3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.

4. Disposal:

   a. Legally dispose of chlorinated water.
   b. Apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.

5. After final flushing and before pipeline is connected to existing system or placed in service, certify that disinfectant level meets quality standards of authority having jurisdiction.

B. Prepare test and inspection reports.

1. After final flushing has been completed a bacteriological sample shall be taken in accordance with AWWA C651-86 Section 7.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment shall be made for Disinfection of Water Utility Piping Systems. Include all such costs under the lump sum prices for the various piping-related items in the Bid Form.

END OF SECTION 330110.58

SECTION 330561 - CONCRETE MANHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide precast concrete manholes for sanitary sewer system as shown on the drawings.

B. Provide precast concrete manholes for storm sewer as shown on the drawings.

1.2 SUMMARY

A. Section Includes:

1. Concrete and masonry manholes.
2. Frames and covers.
3. Riser rings.
4. Pile support systems.

B. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for concrete type for manhole and structure foundation slab construction.
2. Section 333100 "Sanitary Sewerage Piping" for piping connections to manholes.

1.3 DEFINITIONS

A. Bedding: A type of specialized material placed under manhole prior to installation and subsequent backfill operations.

1.4 COORDINATION

A. Coordinate Work of this Section with project owner; Department of Public Works; Utility Authority and all other agencies involved in this work.

B. Notify affected utility companies at least 72 hours prior to construction.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Preinstallation Conference: Conduct conference prior to contractor mobilizing to the project location. Engineer to coordinate with owner, contractor, other utilities, and funding agency (if applicable).

1.6 SUBMITTALS

A. Product Data:

1. Concrete and masonry manholes.
2. Frames and covers.
3. Riser rings.
4. Pile support systems.

B. Shop Drawings:

1. Provide a shop for each individual manhole structures.
2. Indicate structure locations and elevations.
3. Indicate sizes and elevations of all piping, penetrations.
4. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Source Quality-Control Reports: For manholes and covers.

D. Field Quality-Control Reports: For manholes and covers.

E. Qualifications Statement: For manufacturer.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record rim elevations, pipe invert elevations and actual locations of pipe runs, connections manholes and cleanouts.

B. The Contractor shall provide a set of reproducible as-built drawings prior to final payment.

C. Project Record Documents (As-builts) shall be reproducible of the original contract drawings including any additional sheets required. All deviations from the original contract drawings shall be on the as-builts. The drawings shall be legible, neat, and of a quality acceptable to the Engineer.

1. The Contractor shall be responsible for keeping the as-built up-to-date as the project progresses.
2. Sanitary Sewer Cleanouts: Cleanouts shall be indicated by means of triangulation from the front of the building(s). If no building exists, then by three permanent features.
3. Sanitary Sewer Mains: Actual distance between each structure. From center of manhole to center of manhole. Pipe slope and directional of flow shall be provided.
4. Sanitary Sewer/Storm Sewer Manholes: Each manhole should record rim elevation and all invert elevations, manhole material, pipe material, and pipe size. At each manhole tie dimensions shall be provided to three permanent features.
5. This section is intended to provide a minimum level of acceptance. Any section with more stringent requirements shall have precedence over this section.

1.8 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three (3) years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
3. Repair property damaged from materials storage.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.10 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 50 degrees Fprior to, during, and 48 hours after completion of masonry Work.

B. Cold Weather Requirements: Comply with ACI 530/530.1.

1.11 WARRANTY

A. Furnish one year manufacturer's warranty for concrete manholes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. Select one of the three subparagraphs below.
2. The State of New Jersey (NJ) Department of Transportation standards.

3. The state of New Jersey (NJ) Department of Environmental Protection standards.
4. The Municipality of Pennsauken Department of Public Works standards.

2.2 CONCRETE AND MASONRY MANHOLES

A. Manufacturers:

1. Atlantic Precast Products
2. Garden State Precast
3. Peerless Concrete Products
4. Hanson Pipe & Precast.
5. Monarch Products, Inc.
6. Oldcastle Infrastructure Inc.; CRH Americas.
7. Approved Equal.

B. Reinforced Precast Concrete Manhole Sections:

1. Comply with ASTM C478
2. Gaskets: Comply with ASTM C923.
3. Joints:

    a. Comply with ASTM C913.
    b. Maximum Leakage: 0.025 gal. per hour per footof joint at 3 feet of head.

C. Reinforced Cast-in-Place Concrete Manhole Sections: As specified in Section 033000 "Cast-in-Place Concrete".

D. Concrete Brick or Block Units:

1. As specified in Section 042000 "Unit Masonry".
2. Comply with ASTM C55.
3. Weight: Normal.

E. Clay Brick Units:
1. Comply with ASTM C32 & AASHTO M91.
2. Grade: SS
3. Configuration: Solid.

F. Mortar and Grout:

1. Mortar:

    a. As specified

G. Reinforcement:

1. Formed steel reinforcing rods.
2. Thickness: #5 bars
3. Finish: Unfinished.

H. Shaft and Concentric Cone Top Sections:

1. Pipe Sections: Reinforced precast concrete.
2. Joints:

    a. Lipped male/female.
    b. Dry.

3. Sleeved to receive pipe conduit.

I. Shape: Cylindrical; Square; Rectangular.

J. Clear Inside Dimensions:

1. Diameter: 48 inches.
2. As indicated on Drawings.

K. Design Depth:
1. As indicated on Drawings.

L. Clear Cover Opening:

1. Diameter: 26 inches (minimum.
2. As indicated on Drawings.

M. Pipe Entry: Furnish openings as indicated on Drawings.

N. Structure Joint Gaskets:

1. Comply with ASTM C361.
2. Material: Rubber; Buytl Tape.

2.3 FRAMES AND COVERS

A. Manufacturers:

1. Campbell Foundry.
2. EJ.
3. Neenah Foundry Company.
4. Approved Equal.

B. Cast iron.

C. Comply with ASTM A48/A48M, Class 30B, AASHTO M306.

D. Lid:

1. Bearing Surface: Machined flat.
2. Configuration: Removable.
3. Security: None.

E. Cover Design: Closed; Open checkerboard grille; Waterproof.

F. Live-Load Rating: H20

G. Furnish sealing gasket.

H. Cover: Molded with identifying name.

I. Grate: Bicycle safe.

J. Nominal Lid or Grate Size: Based on exact design information.

2.4 RISER RINGS

A. Manufacturers:

1. Atlantic Concrete Precast
2. Atlantic Precast Products
3. Garden State Precast
4. Peerless Concrete Products
5. EJ.
6. Neenah Foundry Company.

B. Riser Rings:

1. Thickness of 2 to 6 Inches (100 to 150 mm):

    a. Precast concrete.
    b. Comply with ASTM C478.

2. Thickness Less Than 4 Inches (100 mm):

    a. Cast iron.
    b. Comply with AASHTO M306.

3. Rubber Seal Wraps:

    a. Wraps and Band Widths: Comply with ASTM C877, Type III.
    b. Cone/Riser Ring Joint: Minimum 3-inchoverlap.
    c. Frame/Riser Ring Joint: 2-inch overlap.
    d. Additional Bands: Overlap upper band by 2 inches.

C. Clay Brick Units:

1. As specified in Section 034100 "Precast Structural Concrete" 042000 "Unit Masonry".
2. Comply with ASTM C32, AASHTO M91.
3. Grade: SS.
4. Configuration: Solid.
5. Nominal modular size of Based on exact design information.

2.5 PILE SUPPORT SYSTEMS

A. Timber Piles: As specified in Section 316219 "Timber Piles."

B. Timber for Cradles:

1. Material: Douglas fir, well seasoned.
2. As specified in Section 061300 "Heavy Timber Construction."
3. Surfacing: On four sides with preservative treatment.
4. Preservative Treatment: As specified in Section 316219 "Timber Piles."

C. Concrete Cradle:

1. As specified in Section 033000 "Cast-in-Place Concrete."
2. Description:

    a. Type: Reinforced
    b. Strength: 4,000 psi at 28 days.
    c. Finish: Rough troweled.

2.6 SUSTAINABILITY CHARACTERISTICS

A. Recycled Content Materials: Furnish materials with maximum available recycled content

B. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

C. Certified Wood Materials: Furnish wood materials certified according to FSC standards

2.7 MATERIALS

A. Cover and Bedding:

1. Bedding: Fill Type A4.
2. Cover: Fill Type A2

2.8 ACCESSORIES

A. Steps:

1. As required by applicable, code.
2. Rungs: Formed PP or aluminum.
3. Fabrication: Formed integral with manhole sections.
4. Diameter: 3/4 inch.
5. Width:

    a. 12 inches.
    b. As indicated on Drawings.

6. Spacing:

    a. 16 incheso.c. vertically, set into structure wall.
    b. As indicated on Drawings.

B. Foundation Slab:

1. Cast-in-place concrete as specified in Section 033000 "Cast-in-Place Concrete".
2. Precast concrete as specified in Section.
3. Top Surface: Level.

C. Strap Anchors:

1. Shape: Bent steel.
2. Finish: **Galvanized**.

D. Joint Sealant: Comply with ASTM C990.

E. Fasteners: Stainless steel; ASTM F593; Galvanized steel; ASTM F1554.

F. Geotextile Filter Fabric:
1. Non-biodegradable; **woven**.
2. Comply with AASHTO M288.
3. Class: **A**.

G. Concrete: As specified in Section 033000 "Cast-in-Place Concrete".

H. Grout: As specified in Section 033000 "Cast-in-Place Concrete" 040516 "Masonry Grouting".

I. Watertight PE Manhole Insert:

1. Manufacturers:

    a. Parson Environmental Products, Inc.

J. Expandable Pipe Plug:

1. Manufacturers:

    a. Petersen Products Co.
    b. Taylor Made Plastics Inc. (TMP).

K. Soil Backfill from Above Pipe to Finish Grade:

1. Soil Type S2, as specified in Section 310513 "Soils for Earthwork".
2. Subsoil: No frozen earth, or foreign matter, or rocks more than 6 inches in diameter.

2.9 FINISHES

A. Bituminous Interior Manhole Coating:

1. Manufacturers:

    a. Polyglass U.S.A., Inc.

B. Steel Galvanizing:

1. Hot-dip galvanize after fabrication.
2. Comply with ASTM A123/A123M.

2.10 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven (7) days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven (7) days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

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 ground areas for suitable conditions where concrete manholes will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.

B. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.

C. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.

D. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION OF CONCRETE MANHOLES

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

B. Correct over-excavation with fine aggregate, coarse aggregate, lean concrete.

C. Remove large stones or other hard matter impeding consistent backfilling or compaction.

D. Protect manhole from damage or displacement while backfilling operation is in progress.

E. Excavating:
1. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill, and placement of geotextile filter fabric.
2. If ground water is encountered, prevent accumulation of water in excavations, place manhole or structure in dry trench.
3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Engineer.

F. Base and Alignment:

1. Place foundation slab and trowel top surface level.
2. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel as indicated on Drawings.
3. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.
4. Install manholes supported at proper grade and alignment on compacted crushed-stone bedding support system as indicated on Drawings.
5. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel as indicated on Drawings.
6. Form and place manhole or structure cylinders plumb and level, to correct dimensions and elevations.

G. Coating: Paint interior with two coats of bituminous interior coating at rate of **120 sq. ft./gal.** for each coat.

H. Precast Concrete Manholes:

1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Assembly:

a. Assemble multisection manholes and structures by lowering each section into excavation.
b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
c. Lower, set level, and firmly position base section before placing additional sections.

4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
5. Maintain alignment between sections by using guide devices affixed to lower section.
6. Joint sealing materials may be installed on Site or at manufacturer's plant.
7. Verify that installed manholes and structures meet required alignment and grade.
8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
9. Cut pipe flush with interior of structure.
10. Shape inverts through manhole and structures as indicated on Drawings.

I. Masonry Manholes:

1. Maintain masonry courses to uniform dimension.
2. Form vertical and horizontal joints of uniform thickness.
3. Lay masonry units in running bond.
4. Course one unit and one mortar joint to equal 8 inches.
5. Form flush mortar joints.
6. Lay masonry units in full bed of mortar with full head joints, uniformly jointed with other Work.
7. Install joint reinforcement 16 inches o.c.
8. Place joint reinforcement in first and second horizontal joints above base pad and below cover frame opening.

J. Cast-in-Place Concrete Manholes:

1. Bear firmly and fully on compacted crushed stone bedding support system as indicated on Drawings.
2. Erect and brace forms against movement as specified in Section 031000 "Concrete Forming and Accessories."
3. Install reinforcing steel as indicated on Drawings and as specified in Section 032000 "Concrete Reinforcing."
4. Place and cure concrete as specified in Section 033000 "Cast-in-Place Concrete."
5. Frames and Covers:

a. Set frames using mortar and masonry.
b. Install radially laid concrete brick with 1/4-inchthick, vertical joints at inside perimeter.
c. Lay concrete brick in full bed of mortar and completely fill joints.
d. If more than one course of concrete brick is required, stagger vertical joints.
e. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas, to allow area to be graded away from cover beginning 1 inch below top surface of frame.

K. Doghouse Manholes and Structures:

1. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.
2. Carefully excavate around existing sewer line to adequate depth for foundation slab installation.
3. Protect existing pipe from damage.
4. Cut out soft spots and replace with granular fill compacted to 95 percent maximum density.
5. Bear firmly and fully on compacted crushed stone bedding support system as indicated on Drawings.
6. Install precast concrete, Construct cast-in-place concrete, Construct masonry concrete manhole or structure around existing pipe according to applicable Paragraphs in this Section.
7. Grout pipe entrances as specified in Section 033000 "Cast-in-Place Concrete".
8. Perform connection to existing pipe between hours of 12:00 AM and 4:00 AM.
9. Block upstream flow at existing manhole or structure with expandable plug.
10. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up OD on each side of pipe.
11. Bottom half of pipe is to remain as manhole flow channel.
12. Saw cut to smooth finish with top half of pipe flush with interior of manhole or structure.
13. Grout base of manhole or structure to achieve slope to manhole or structure channel as specified in Section 033000 "Cast-in-Place Concrete" and trowel smooth.

L. Sanitary Manhole Drop Connections:

1. Concrete Encasement: Minimum 2 feet outside of manhole.
2. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.
3. As indicated on Drawings.

M. Castings:

1. Set frames using mortar and masonry as indicated on Drawings.
2. Install radially laid concrete brick with 1/4-inchthick, vertical joints at inside perimeter.
3. Lay concrete brick in full bed of mortar and completely fill joints.
4. If more than one course of concrete brick is required, stagger vertical joints.
5. Set frame and cover **2 inches** above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning **1 inch** below top surface of frame.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Cast-in-Place Concrete: As specified in Section 033000 "Cast-in-Place Concrete".
2. Concrete Manhole Sections: Comply with ASTM C497As specified in Section 330505.33 "Infiltration and Exfiltration Testing" As specified in Section 330505.36 "Vacuum Testing".
3. Concrete manholes will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Vertical Adjustment of Existing Manholes and Structures:

1. As specified in Section 330130.86 "Manhole Rim Adjustment".
2. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
3. Frames, Grates, and Covers:

    a. Remove frames, grates, and covers cleaned of mortar fragments.
    b. Reset to required elevation according to requirements specified for installation of castings.

4. Reinforcing Bars:

    a. Remove concrete without damaging existing vertical reinforcing bars if removal of existing concrete wall is required.
    b. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.

5. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 033000 "Cast-in-Place Concrete".

PART 4 - QUANTITY AND PAYMENT

4.1 Installation of new manholes and connection to existing and proposed manholes

A. Quantity: The quantity of the new manhole and connection to existing and proposed manholes for which payment will be made will be the number of each constructed in accordance with the drawings and specifications or as directed by the Engineer.

B. Payment: No separate Payment will be made for the Installation of the new Manholes and for the Connection to the existing and proposed manholes. The contractor shall include in the lump sum bid item “INSTALLATION OF NEW SEWER LINE, COMPLETE” which price shall include but not limited to the cost of excavation, 3/4" broken stone bedding, haunching, initial backfill, in accordance with these specifications, backfill, dewatering, furnishing pipe and fittings, laying, assembling and jointing pipe complete, testing trench bottom materials, flushing, inspection, shoring, sheathing, timbering, bracing, by-pass pumping, service disconnection removal and disposal of existing terracotta sanitary sewer main, installation of new 8" PVC pipe, connection to existing manholes, installation of new manhole, concrete, brick, or block, frames and covers, step irons all materials labor and equipment blocking, shoring and sheathing left in place, all labor and materials, equipment and all else necessary therefore and all other work in connection therewith and incidental thereto.

END OF SECTION 330561

SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping.
2. Tapping sleeves and valves.
3. Valves and hydrants.
4. Reduced-pressure backflow preventers.
5. Pile support systems.
6. Concrete encasement and cradles.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete for cradles and encasements.
2. Section 312317 "Trenching Excavation and Backfill".

1.2 SUBMITTALS

A. Product Data:

1. Piping.
2. Tapping sleeves and valves.
3. Valves and hydrants.
4. Reduced-pressure backflow preventers.
5. Pile support systems.
6. Concrete encasement and cradles.

B. Field Quality-Control Reports: For piping and related equipment.

C. Qualifications Statements: For manufacturer and installer.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience in installation of Work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store materials according to manufacturer instructions.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 WARRANTY

A. Furnish one year manufacturer's warranty for valves and pipes

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersery (NJ) Department of Transportation standards.
2. The Municipality of Pennsauken Department of Public Works standards.

2.2 PIPING

A. Ductile Iron Pipe:

1. Comply with AWWA C104.
2. Fittings:

a. Material: Ductile iron.

b. Thickness: Standard.

3. Joints:

a. Comply with AWWA C111.
b. Provide rubber gasket with rods.

4. Jackets: AWWA C105 PE jacket.

B. Copper Tubing:

1. Comply with ASTM B88.
2. Type K, annealed.
3. Fittings: ASME B16.18, cast copper.
4. Joints: Compression connection.

C. PVC Pipe:

1. ASTM D1785, Schedule 80
2. Fittings: PVC, ASTM D2466.
3. Joints:

a. Comply with ASTM D2855.
b. Type: Solvent weld.

D. PVC Pipe with Cast Iron Fittings:

1. Comply with AWWA C900, Class 165.
2. Cast Iron Fittings: Comply with AWWA C111.
3. Joints:

a. Comply with ASTM D3139.
b. Furnish compression gasket ring.

2.3 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Manufacturers:

a. Kennedy Valve Company; a division of McWane, Inc.
b. Mueller Co.
c. U.S. Pipe.

B. Description:

1. Material: Ductile or cast iron.
2. Type: Dual compression.
3. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125, and MSS SP-60.

C. Tapping Valves:

1. Manufacturers:

a. Kennedy Valve Company; a division of McWane, Inc.
b. Mueller Co.
c. U.S. Pipe Valve & Hydrant Division.

D. Description:

1. Comply with AWWA C500.
2. Type: Double disc with non-rising stem.
3. Inlet Flanges: Comply with ASME B16.1, Class 125, and MSS SP-60.
4. Mechanical Joint Outlets: Comply with AWWA C111.
5. Mark manufacturer's name and pressure rating on valve body.

2.4 VALVES AND HYDRANTS

A. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 "Valves and Hydrants for Water Utility Service."

2.5 REDUCED-PRESSURE BACKFLOW PREVENTERS

A. Manufacturers:

1. FEBCO; A WATTS Brand.
2. Flomatic Corporation.
3. Matco-Norca.
4. NIBCO INC.
5. WATTS.
6. Zurn Industries, LLC.

B. Description:

1. Comply with ASSE 1013.
2. Materials:

a. Body: Bronze.
b. Internal Parts: Bronze.
c. Springs: Stainless steel.

3. Check Valves:

a. Quantity: Two.
b. Description: Independently operating, spring loaded.
c. Type: Diaphragm type, differential pressure relief, located between check valves.
d. Provide third check valve opening under back pressure in case of diaphragm failure.
e. Vent Outlet: Non-threaded.

4. Furnish two gate valves, one strainer, and four test cocks.

C. Double Check Valve Assemblies:

1. Comply with ASSE 1012.
2. Description: Two independently operating check valves, with intermediate atmospheric vent.
3. Materials:

a. Body: Bronze.
b. Internal Parts: Corrosion resistant.
c. Springs: Stainless steel.

2.6 PILE SUPPORT SYSTEMS

A. Timber for Cradle:

1. Species: Douglas fir, well seasoned.

2.7 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 033000 "Cast-in-Place Concrete."
2. Type: Reinforced, air entrained.
3. Compressive Strength: 4,000 psi at 28 days.
4. Finish: Rough troweled.

2.8 SUSTAINABILITY CHARACTERISTICS

A. Recycled Content Materials: Furnish materials with maximum available recycled content Insert list of materials specified in this Section required to have recycled content.

B. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

2.9 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type A1, A2, A3, or A4.
2. Cover: Fill Type A1, A2, A3, or A4.
3. Soil Backfill from Above Pipe to Finish Grade:

a. Soil Type S1 or S2
b. Subsoil with no rocks greater than 6 inches in diameter, frozen earth, or foreign matter.

2.10 ACCESSORIES

A. Steel Rods, Bolt, Lugs, and Brackets:

1. Comply with ASTM A36/A36M.
2. Grade A carbon steel.

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 site water utility distribution piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

D. Protect and support existing distribution piping and appurtenances as Work progresses.

3.3 INSTALLATION OF SITE WATER UTILITY DISTRIBUTION PIPING

A. Bedding:

1. Excavate pipe trench as specified in Section 312317 "Trenching Excavation and Backfill"
2. Placement:

a. Place bedding material as indicated on Drawings.
b. Level fill materials in one continuous layer not exceeding 6 inches of compacted depth.
c. Compact to 95 percent maximum density.

3. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 95percent maximum density.
4. Maintain optimum moisture content of fill material to attain required compaction density.

B. Pipe and Fittings:

1. Maintain separation of water main from sewer piping according to NJDEP code.

2. Group piping with other Site piping work whenever practical.
3. Install pipe to elevations indicated on Drawings.
4. Install ductile-iron piping and fittings according to AWWA C600.
5. Install grooved and shouldered pipe joints according to AWWA C606.
6. Route pipe in straight line.
7. Thrust Restraints:

    a. Form and place concrete for pipe thrust restraints at each elbow or change of pipe direction.
    b. Place concrete to permit full access to pipe and pipe accessories.
    c. Provide bearing area as indicated on Drawings.

8. Establish elevations of buried piping with not less than 5' 6" of cover.

3.4 TOLERANCES

A. Install pipe within tolerance of 5/8 inch.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Pressure test piping system according to AWWA C600.
2. Pressure test piping system as indicated on pipe schedule.
3. Pressure test piping system according to AWWA C600 and following:

    a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
    b. Conduct hydrostatic test for a minimum of two hours.
    c. Slowly fill section to be tested with water; expel air from piping at high points.
    d. Install corporation cocks at high points.
    e. Close air vents and corporation cocks after air is expelled.
    f. Raise pressure to specified test pressure.
    g. Observe joints, fittings, and valves under test.
    h. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage, and retest.
    i. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
    j. Maintain pressure within plus or minus 5 psi of test pressure.
    k. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
    l. Compute maximum allowable leakage using following formula:

        1) L = SD x sqrt(P)/C.
        2) L = testing allowance, gph.
        3) S = length of pipe tested, feet.
        4) D = nominal diameter of pipe, inches.

5) P = average test pressure during hydrostatic test, psig.
6) C = 148,000.

m. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
n. Leakage:

1) If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
2) Correct visible leaks regardless of quantity of leakage.

4. Compaction Testing:

a. Comply with ASTM D1557.
b. Frequency of Compaction Tests:.
c. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

PART 4 - QUANTITY AND PAYMENT

4.1 All ductile iron pipe, fittings, and all associated cost will be made as a lump sum under the line item, “SITE PIPING, VALVES, FITTINGS, HYDRANT AND APPURTENANCES” as provided in the Bid Form. The price shall include the cost of excavating, dewatering, laying, assembling and jointing of the pipe complete, shoring, pumping, backfilling, concrete thrust blocks, bedding, cutting, testing, concrete encasement (if shown), supply and installation of all the components of the hydrant and of the hydrant line, supply and installation of chlorine contact piping, and all other site piping and connections to existing piping system, all materials, labor, equipment, and all else necessary therefore and all other work in connection therewith and incidental thereto.

END OF SECTION 331416

SECTION 331419 - VALVES AND HYDRANTS FOR WATER UTILITY SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valves.
2. Fire hydrants.
3. Valve boxes.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete for thrust restraints.
2. Section 330110.58 "Disinfection of Water Utility Piping Systems" for requirements for flushing and disinfecting.
3. Section 331416 "Site Water Utility Distribution Piping" for pressure testing of valves and hydrants.

1.2 UNIT PRICES

A. Valves:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes excavation, valve, valve box, accessories, bedding, and backfill.

B. Fire Hydrants:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes excavation, hydrant, isolation valve and box, accessories, foundation bedding, and backfill.

1.3 COORDINATION

A. Coordinate Work of this Section with installation of water mains.

1.4 SUBMITTALS

A. Product Data:

1. Valves.
2. Fire hydrants.
3. Valve boxes.

B. Source Quality-Control Reports: For valves, valve boxes, and fire hydrants.

C. Qualifications Statements: For manufacturer and installer.

D. Manufacturer's Approval: For installer.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates: For the source and origin for salvaged and reused products.

B. Product Certificates: For recycled material content for recycled content products.

C. Product Certificates: For the source of regional materials and distance from Project Site.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and hydrants.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Tools: Furnish one tee wrench of required length to Owner.

1.8 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

B. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

C. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

D. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Seal valve and hydrant ends to prevent entry of foreign matter.
2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. The Municipality of Pennsauken Department of Public Works standards.

2.2 VALVES

A. Performance and Design Criteria:

1. Pressure Rating:

    a. 12-inch (300-mm) Diameter and Smaller: 200 psig.
    b. 14-inch (350-mm) Diameter and Larger: 150 psig.

2. End Connections: Flanged.
3. Furnish valves of diameters 16 inchesand larger with bypass valves and gear operators.
4. Coatings:

    a. Comply with AWWA C550.
    b. Application: Interior and exterior.

B. Double-Disc Gate Valves:

1. Manufacturers:

    a. Clow Valve Company; a subsidiary of McWane, Inc.
    b. Kennedy Valve Company; a division of McWane, Inc.
    c. Mueller Co.
    d. Val-Matic Valve & Manufacturing Corp.

2. Comply with AWWA C500.
3. Materials:

    a. Body: Iron.
    b. Trim: Bronze.

4. Seat Type: Double disc; parallel.
5. Stem:

    a. Type:Rising.
    b. Seals: O-ring.

6. Operation:

    a. Square operating nut with counterclockwise opening direction.
    b. Handwheel with counterclockwise opening direction.

C. Resilient-Wedge Gate Valves:

1. Manufacturers:

    a. American Cast Iron Pipe Company.
    b. Clow Valve Company; a subsidiary of McWane, Inc.
    c. Mueller Co.
    d. NIBCO INC.

2. Comply with AWWA C509.
3. Body: Ductile iron.
4. Seats: Resilient.
5. Stem:

    a. Type: Non-rising.
    b. Material: Bronze.

6. Operation:

    a. Square operating nut.
    b. Opening Direction: Counterclockwise.

2.3 FIRE HYDRANTS

A. Manufacturers:

1. American Cast Iron Pipe Company.
2. Kennedy Valve Company; a division of McWane, Inc.
3. Mueller Co.

B. Dry-Barrel, Breakaway Type:

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Valve: Compression type.
4. Burial Depth: As indicated on Drawings.
5. Inlet Connection Size: 6 inches.
6. Valve Opening: 5-1/4 inches in diameter.
7. End Connections: Mechanical joint.
8. Bolts and Nuts: Stainless steel.
9. Interior Coating: Comply with AWWA C550.
10. Opening Direction: Counterclockwise.

C. Wet-Barrel Type:

1. Comply with AWWA C503.

2. Body: Cast iron.
3. Valve Openings: Individual for pumper and hose nozzles.
4. End Connections: Mechanical joint.
5. Bolts and Nuts: Stainless steel.
6. Interior Coating: Comply with AWWA C550.
7. Opening Direction: Counterclockwise.

D. Hose Connections:

1. One pumper, two hose nozzles.
2. Obtain thread type and size from local fire department.
3. Attach nozzle caps by separate chains.

E. Finishes:
1. Color: Comply with requirements of Owner.

2.4 VALVE BOXES

A. Manufacturers:

1. Ford Meter Box Company, Inc. (The).
2. Mueller Co.
3. Tyler Utilities; Union Foundry Company.

B. 12-inch (300-mm) Diameter Valves and Smaller:

1. Material: Cast iron.
2. Type: Two piece; screw.

C. Valves Larger than 12-inch (300-mm) Diameter:

1. Material: Cast iron.
2. Type: Three piece; screw.
3. Base: Round.

2.5 SUSTAINABILITY CHARACTERISTICS

A. Recycled Content Materials: Furnish materials with maximum available recycled content

B. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site

2.6 ACCESSORIES

A. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.

2.7 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make completed valves and hydrants available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions , with Installer present, for compliance with requirements for maximum moisture content, installation tolerances , Insert other specific conditions, and other conditions affecting performance of the Work.

B. Determine exact location and size of valves from Drawings.

C. Identify required lines, levels, contours, and datum locations.

D. Verify that elevations of existing facilities prior to excavation and installation of valves and hydrant] are as indicated on Drawings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Locate, identify, and protect from damage utilities to remain.

B. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Engineer not less than 5 days in advance of proposed utility interruption.
2. Do not proceed without written permission from Engineer.

3.3 INSTALLATION OF VALVES AND HYDRANTS

A. Install valves and hydrants in conjunction with pipe laying.

B. Provide buried valves with valve boxes installed flush with finished grade.

C. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.

D. Orientation:

1. Set valves and hydrants plumb.
2. Set fire hydrants with pumper nozzle facing roadway.
3. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade and with safety flange not more than 6 inches nor less than 2 inches above grade.

E. After main-line pressure testing, flush fire hydrants and check for proper drainage.

F. Disinfection of Water Piping System: Flush and disinfect valves and hydrants with water mains as specified in Section 330110.58 "Disinfection of Water Utility Piping Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing: Pressure test valves and hydrants with water mains as specified in Section 331416 "Site Water Utility Distribution Piping."

C. Prepare test and inspection reports.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment shall be made for Valves and Hydrants for Water Utility Service. The Contractor shall include the cost for the supply of the hydrant and all other items required for a complete installation in the unit price bid under “SITE PIPING, VALVES, FITTINGS, HYDRANT AND APPURTENANCES” as provided in the Bid Form. The price shall include the cost of excavating, dewatering, laying, assembling and jointing of the pipe complete, shoring, pumping, backfilling, concrete thrust blocks, bedding, cutting, testing, concrete encasement (if shown), supply and installation of all the components of the hydrant and of the hydrant line, supply and installation of chlorine contact piping, and all other site piping and connections to existing piping system, all materials, labor, equipment, and all else necessary therefore and all other work in connection therewith and incidental thereto.

END OF SECTION 331419

SECTION 333100 - SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Piping – Sanitary Sewer Piping shall include the excavation and backfill for and the construction, furnishing and installation of gravity sewers for conveying sanitary sewage in accordance with the drawings and specifications and as directed by the Engineer.

B. Also included shall be any by-pass piping and pumping required to construct this pipeline and keep the existing sanitary sewer main in continuous service.

1.2 SUMMARY

A. Section Includes:

1. Sanitary sewerage piping.
2. Manholes.
3. Flexible couplings.
4. Flexible pipe boots for manhole pipe entrances.

B. Related Requirements:
1.
2. Section 312317 "Trenching Excavation and Backfill" for requirements for excavation and backfill as required by this Section.
3. Section 330561 "Concrete Manholes" for manholes for sanitary sewerage piping.

1.3 DEFINITIONS

1.4 COORDINATION

A. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Preinstallation Conference: Conduct conference prior to contractor mobilizing to the project location. Engineer to coordinate with owner, contractor, other utilities, and funding agency (if applicable).

1.6 SUBMITTALS

A. Product Data:

1. Sanitary sewerage piping.
2. Manholes.
3. Flexible couplings.
4. Flexible pipe boots for manhole pipe entrances.

B. Source Quality-Control Reports: For piping and accessories.

C. Field Quality-Control Reports: For piping and accessories.

D. Qualifications Statements: For manufacturer and installer.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections manholes and cleanouts.

B. The Contractor shall provide a set of reproducible as-built drawings prior to final payment.

C. Project Record Documents (As-builts) shall be a reproducible of the original contract drawings including any additional sheets required. All deviations from the original contract drawings shall be on the as-builts. The drawings shall be legible, neat, and of a quality acceptable to the Engineer.

1. The Contractor shall be responsible for keeping the as-built up-to-date as the project progresses.
2. Sanitary Sewer Cleanouts: Cleanouts shall be indicated by means of triangulation from the front of the building(s). If no building exists, then by three permanent features.
3. Sanitary Sewer Mains: Actual distance between each structure. From center of manhole to center of manhole. Pipe slope and directional of flow shall be provided.
4. Sanitary Sewer Manholes: Each manhole should record rim elevation and all invert elevations, manhole material, pipe material, and pipe size. At each manhole tie dimensions shall be provided to three permanent features.
5. This section is intended to provide a minimum level of acceptance. Any section with more stringent requirements shall have precedence over this section.

1.8 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store materials according to manufacturer instructions.
2. Store valves in shipping containers with labeling in place.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work Perform Work in accordance with the Department of Environmental Protection that the work is being performed in.

2.2 SANITARY SEWERAGE PIPING

A. Plastic Pipe (PVC) with Bell and Spigot End Connections with Rubber-Ring-Sealed Gasket Joint:

1. Material: PVC.
2. Comply with ASTM D3034, SDR-[35].
3. Inside Nominal Diameter: 6 AND 8 inches,
4. Fittings: PVC.
5. Joints:

    a. Elastomeric gaskets.
    b. Comply with ASTM F477.

B. Plastic Pipe (PVC) for Piping Up to 12 Inches (300 mm) in Diameter:

1. Material: PVC, Schedule [40] [80] [120].
2. Comply with ASTM D1785.
3. Inside Nominal Diameter: 8 inches
4. End Connections: Bell and spigot with solvent-sealed ends.
5. Fittings:

    a. Material: PVC.
    b. Comply with ASTM D2466.

6. Joints:

    a. Solvent welded with solvent cement according to ASTM D2564.
    b. Comply with ASTM D2855.

2.3 MANHOLES

A. As specified in Section 330561 "Concrete Manholes."

2.4 FLEXIBLE COUPLINGS

A. Manufacturers:

1. Fernco Inc.
2. Romac Industries, Inc.
3. Approved Equal

B. Material: Resilient, chemical-resistant, elastomeric PVC.

C. Attachment: Two Series-300 stainless-steel clamps, screws, and housings.

2.5 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

A. Manufacturers:

1. A-Lok.
2. Press-Seal Corporation.
3. Approved Equal

B. Material: EPDM.

C. Comply with ASTM C923.

D. Attachment: Series-300 stainless-steel clamp and hardware.

2.6 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill.
2. Cover: Fill
3. Soil Backfill from Above Pipe to Finish Grade:

    a. Soil Type ".
    b. Subsoil with no rocks more than 2 inchesin diameter, frozen earth, or foreign matter.

2.7 MIXES

A. Grout:.

2.8 ACCESSORIES

A. Pipe Markers.

2.9 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of pipe.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Correct over-excavation with coarse aggregate.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

D. Protect and support existing sewer lines, utilities, and appurtenances.

E. Utilities:

1. Maintain profiles of utilities.
2. Coordinate with utilities to eliminate interference.
3. Notify Engineer if crossing conflicts occur.

F. Bedding:
1. Excavate to lines and grades as indicated on drawings, or as required to accommodate installation of encasement.
2. Dewater excavations (if necessary) to maintain dry conditions and to preserve final grades at bottom of excavation.
3. Placement:

a. Place bedding material at trench bottom.
b. Level materials in continuous layer not exceeding 6-inchcompacted depth.
c. Compact to 95 percent of maximum density.

G. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
2. Lay pipe to slope gradients as indicated on Drawings.
3. Begin at downstream end of system and progress upstream.
4. Bedding:

a. Install at sides and over top of pipe, to minimum compacted thickness to top of pipe.

5. Lay bell-and-spigot pipe with bells upstream.
6. PE Pipe Encasement: Comply with AWWA C105.
7. Backfill and compact as specified in Section 312317.
8. Do not displace or damage pipe when compacting.
9. Connect pipe to connection shown on the drawings.
10.

H. Manholes: As specified in Section 330561 "Concrete Manholes."

I. Backfilling:

1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 8 inches.
2. Tamp fill in place, and compact to 95 percent of maximum density.
3. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
4. Maintain optimum moisture content of bedding material as required to attain specified compaction density.
5. As specified in Section 312323 "Fill."

3.3 TOLERANCES

A. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

3.4 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Perform testing on Site sanitary sewage system according to local code, and per the Department of Environmental Protection in the State in which the work is performed.
3. Compaction Testing:

    a. Comply with AASHTO T 180; ASTM D698; ASTM D1557; ASTM D6938.

C. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

B. Cap open ends of piping during periods of Work stoppage.

PART 4 - QUATITY AND MEASUREMENT

4.1 SANITARY SEWER PIPE

A. Quantity: The quantity of Sanitary Sewer Pipe for which payment shall be made will be the actual lengths measured from centerline of manholes as constructed in accordance with drawings and specifications or as directed by the Engineer measured in place where laid. The depth shall be measured from invert of sewer to surface before excavation.

B. Payment: Sanitary Sewer PVC Pipe 8'' will be made for the length and depth as determined above, measured in linear feet and included in the lump sum Bid Form line idem "INSTALLATION OF NEW SEWER LINE ,COMPLETE" which price shall include but not limited to the cost of excavation, 3/4" broken stone bedding, haunching, initial backfill, in accordance with these specifications, backfill, dewatering, furnishing pipe and fittings, laying, assembling and jointing pipe complete, testing trench bottom materials, flushing, inspection, shoring, sheathing, timbering, bracing, by-pass pumping, service disconnection removal and disposal of existing terracotta sanitary sewer main, installation of new 8" PVC pipe, installation of 6" lateral, connection to existing manholes, installation of new manhole, concrete, brick, or block, frames and covers, shoring and sheathing left in place, all labor and materials, equipment and all else necessary therefore and all other work in connection therewith and incidental thereto.

.

END OF SECTION 333100

SECTION 400507 – HANGERS, SUPPORTS ANCHORS AND SEALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Structural attachments.
4. Pipe guides.
5. Anchors
6. Seals

B. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for execution requirements for placement of concrete housekeeping pads specified by this Section.
2. Section 400519 "Ductile Iron Process Pipe Fittings and Specials" for execution requirements for placement of hangers and supports as specified by this Section.
3. Section 400551 "Common Requirements for Process Valves" for common product requirements for valves for placement by this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and as indicated on Drawings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.4 SUBMITTALS

A. Product Data:

1. Pipe hangers and supports.
2. Hanger rods.
3. Structural attachments.
4. Pipe guides.
5. Sleeve and Seal Materials
6. Anchors

B. Shop Drawings:

1. Indicate system layout with location, including critical dimensions, sizes, hanger and support locations, and details of trapeze hangers, anchors, and guides.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

D. Qualifications Statements: For manufacturer, fabricator, installer, and licensed professional.

E. Manufacturer's Approval: For installer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 PIPE SUPPORTS

A. A. Riser Clamps: Support vertical runs of piping at each floor, or closer where required, with carbon steel clamps ASTM A 36 bolted around pipes and attached to the building construction.
1. Provide copper plated clamps for copper tubing support.

B. Hangers: Fabricated of malleable iron ASTM A 47, or carbon steel ASTM A 36.
1. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
2. Hangers for pipe sizes 2-1/2 inches or larger shall incorporate a means of vertical adjustment after erection while supporting the load.
3. Adjustable Band Hangers: Carbon steel band type hangers designed for suspension on hanger rods with provisions for vertical adjustments and locking in position using supporting and locknuts. Provide band hangers to support non-insulated pipe.

4. Clevis Hangers for Non-Insulated Pipe: Carbon steel yoke and U-strap type with cross bolt over pipe.

C. Racks: Multiple pipe racks or trapeze hangers fabricated from steel ASTM A 36 and designed to suit conditions at points of installation.
1. Keep pipes in their relative positions to each other by the use of clamps or clips. Lines subject to thermal expansion must be free to slide or roll.

D. Wastewater Process Piping Base Supports:
1. Concrete Base Supports: Conforming to Base Fitting Support Detail Drawing.
1. Do not use concrete base supports where distance from floor to bottom of unsupported element exceeds six feet.
2. Materials and construction as specified in Concrete.

E. Saddle Base Supports: Unless shown otherwise:
1. Saddle similar to ITT Grinnell Fig. 258, Cast Iron Pipe Saddle Support.
2. Steel pipe column of adequate strength to safely support applied loads and fitted with a steel base anchored to floor.
3. Set pipe column base on a one-inch thick grout bed of non-shrink, non-metallic grout.

F. General:

1. All pipe support surfaces in contact with plastic piping shall be coated with a plastic coating. Coating shall have a smooth and uniform surface and be a minimum of 0.03 inches thick.
2. Except where specified elsewhere to the electro-galvanized all steel pipe support components shall be hot dipped galvanized in accordance with ASTM A 123.

G. Interior of sanitary sewer manholes and wet wells:

1. Materials: Type 316 stainless steel or Aluminum 6061-T6 with Type 316 studs, bolts, nuts and washers.

2.3 MECHANICAL FLOAT AND CABLE SUPPORT

A. In the wet well interior all supports shall be manufactured from minimum 3/16" thick Type 316 stainless steel plate. All portions of the support which may be in contact with cable shall be coated with a minimum 0.030 inches thick PVC coating. Coating to be a uniform thickness.

B. All supports shall be positioned so as to not interfere with the removal of the pumps.

C. In the wet well interior at least one pump cable support shall be provided for each pump.

D. In the wet well interior horizontally aligned mechanical float cable shall be supported every four feet and at all changes in direction.

E. All mechanical float and pump cable supports shall be so located that cable adjustment can easily be performed by operator located on the elevated concrete slab.

2.4 SUMMERSIBLE PUMP GUIDE RAIL SUPPORT AND BRASCKETS

A. Materials:
   1. Pump guide rails and bracket: Type 316 stainless steel.
   2. Intermediate guide rail support: Type 316 stainless steel.
   3. All studs, bolts, nuts and washers shall be Type 316 stainless steel.
   4. Provide one intermediate guide rail support per rail.

2.5 ANCHORS AND FASTNERS

A. Anchor Bolts (Pre-Set): Where anchor bolts are indicated or required as pre-set in cast-in-place concrete, provide anchor bolts of lug or bent shape design.
   1. Galvanized Bolts: ASTM A 307 for bolts, nuts and washers; and ASTM B 695 or A 133 for galvanizing.
   2. Stainless Steel Bolts: ASTM A 320, Grade B8, AISC Type 303 or 304. Provide stainless steel anchor bolts in all locations where the bolt can be immersed in liquid.

B. Drilled-In Expansion Anchors, Fasteners and Rods:

   1. Applications in Masonry (and Precast Concrete Hollow-Core Structural Elements):
      a. Anchors: Provide anchors designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. Expander nut fabricated and designed to climb the boltor rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches and bears against the shield bottom.
         1. Shield Body: Consisting of four legs, the inside of each tapered toward shield bottom (or nut end). The end of one leg is elongated and turned across shield bottom. Outer surface of shield body ribbed for grip-action.
         2. Expander Nut: Square design with sides tapered inward from bottom to top.
         3. Material: Die cast Zamac No. 3 zinc alloy of 43,000 psi minimum tensile strength. Shield and nut made in conformance with S.A.E. 90 3 ASTM XI.
      b. Fasteners: Machine bolts conforming to S.A.E. Grade 2, for use with above anchors; nuts and washers conforming to ASTM A 563.
      c. Acceptable Manufacturers:
         1. U.S.E. Diamond, Inc.; FORWAY System.
         2. Or Approved Equal.
   2. Applications in Cast-in-Place Concrete (and Solid Precast Concrete Structural Elements) and Wet Well/Valve Chamber Interiors:
      a. Expansion anchors shall be HSL heavy duty stainless steel (AISI Type 316) as provided by Hilti Fastening Systems or approved equal.
      b. All other anchors (threaded rods, HAS rod for adhesive anchors, etc.) shall be Type 304 stainless steel.
   3. Note: Hammer drive-type and explosive charge drive-type anchors and fastener systems not acceptable. Lead shields, plastic-inserts, fiber-inserts, and drilled-in plastic sleeve/nail drive systems also not acceptable.

C. Welding Electrodes: Table 4.1.1 of AWS D1.1 as required for applicable base metals and welding process.

2.6 SLEEVES AND SEALS

A. Pipe Sleeve Sizing:

1. Floor and Wall Seal Sleeve: Size sleeves to accommodate the pipe plus the hydrostatic Wall Seal. Set sleeves in position in formwork. Provide reinforcing around sleeve.
2. Sleeve Length:
   a. Wall and Partitions: Equal to total thickness of wall or partitions and terminated flush with finished surfaces.
   b. Floors: Equal to total depth of floor construction including finish and extending a minimum of one inch above floor level.

B. Sleeve Materials:

1. Pipe Sleeves in Concrete: Fabricate from Schedule 40 pipe and weld a 2-inch-wide intermediate anchoring flange of 3/16 inch plate midway on pipe sleeve or fabricated from non-metallic, non-corrosive, thermo plastic material with a water stop and anchor plate 4" larger than the outside diameter. Provide sleeve product similar to Fig. 204 as manufactured by F & S Manufacturing Corporation; Link-Seal Century Line Model as manufactured by Thunderline Corporation or approved equal.
   a. Pipe: Provide Type 316 Stainless Steel Pipe and anchor flange for all penetrations in wet wells, valve chamber, grinder chamber and all other buried locations. Provide blacksteel pipe elsewhere. Anchoring flange is waived for above grade locations.
2. Pipe Sleeves in Masonry: No. 18 gauge galvanized sheet steel; or provide steel product similar to Fig. 202 as manufactured by F & S Manufacturing Corporation, or equal.

C. Wall Pipe: Ductile iron construction with an integral intermediate anchoring flange midway on the pipe exterior.

1. Wall pipe ends of type indicated on Drawings, and where not indicated, pipe end shall match that of adjoining pipe.
2. Provide wall pipes similar to those manufactured by Clow Corporation, American Cast Iron Pipe Co., U.S. Pipe and Foundry Co. or approved equal

D. Seals and Plates:

1. Wall Seal: Hydrostatic modular compression link seal designed to seal opening between pipes and a through structure opening. Provide Link-Seal by Thunderline Corp., or approved equal. In locations where the wall seal is underground or can be immersed, provide Model S Link Seal. For all other locations provide Model C Link Seal. Caulking, mastic sealants, lead/oakum; not equal.
2. Wall and Ceiling Plates: Cast metal with integral set screw or similar anchoring screw. Hinged or split design plates may be provided.

PART 3 - EXECUTION

3.1 PIPING SYSTEM SUPPORT INSTALLATION

A. General:

1. Install pipe supports and anchors to hold piping straight and true to line both vertically and horizontally.
2. Install items to be embedded before concrete placement.
3. Where thermal movement in piping systems will occur, provide piping system supports capable of supporting the line in all operating conditions.
4. The supporting force at each hanger shall prevent excessive stress in the pipe and connected equipment.
5. Install pipe supports anchored directly to or suspended directly from structural supports. Where pipe hangers fall between structural members provide auxiliary steel supports to carry pipe hangers.

B. Spacing of Hangers and Supports:

1. Space hangers and supports as stated herein and in ANSI B31.1, MSS SP 58 and SP 69, and as indicated on the Drawings.
2. Give special consideration to spacing of hangers and supports where components such as fittings and valves impose concentrated loads.
3. Ductile Iron Pipe:
   a. Provide at least one support for each length of pipe with the hanger located adjacent to the joint.
   b. Hanger spacing shall not exceed 12 feet on center.
   c. Support each change of direction or branch connection.
4. Copper Tubing: Space hangers on horizontal runs of copper tubing as follows:
   a. Tube sizes 3/8 through 3/4 inches - 5 ft. O.C. maximum.
   b. Tube size one inch - 6 ft. O.C. maximum.
   c. Tube size 1-1/4 inches - 7 ft. O.C. maximum.
   d. Tube size 1-1/2 through 2 inches - 8 ft. O.C. maximum.
   e. Protect copper from reaction with dissimilar metals.

C. Plastic Piping: Provide hangers at locations and spacing limitations in accordance with pipe manufacturer's installation specifications.

D. Pipe Sleeve Installation:

1. Set pipe sleeves in concrete formwork, walls, partitions, floors and ceilings as construction work progresses. Provide sleeve for each pipe individually.
2. Provide and set sleeves to avoid delaying construction activities of other trades. Perform any additional work under the observation of the Engineer.
3. Fill exterior side of pipe sleeve wall seal with caulking material of an approved color.

E. Seals and Plates Installation:

1. Following pipe installation through sleeves in exterior walls below grade, install Wall Seal to render installation leak free. Wall Seal not required in interior walls, partitions, floor and ceilings.
2. Install Wall seal as close to outside surface of wall as possible to provide a watertight seal below grade. Apply a coating of coal tar paint or other type approved coating on bolt heads and other metal parts on below grade wall seals prior to backfilling.
3. Install wall and ceiling plates to close pipe sleeve openings.

F. Wall Pipe Installations:

1. Provide wall pipes for those installations indicated on the Drawings where piping is cast integrally into the structure.
2. Provide wall pipes with joining ends as match or mate with those of pipes being connected.
3. Provide the proper gaskets, bolts, nuts and washers as required in the pipe joining to wall pipes.
4. Flanged ends and mechanical joint bells shall be drilled and tapped for studs.

G. Existing Structure Penetrations:

1. Make existing masonry and concrete structure penetrations for piping by the core-drilling method. Make such penetrations true, clean and free from spalling.
2. Make wall penetration sized to accommodate the pipe plus the hydrostatic Wall Seal.
3. Provide cast metal escutcheons to close the interior side of the structure penetration.
4. Wall Seal: Provide hydrostatic Wall Seal, as specified previously herein, for underground piping passing through core-drilled openings.

3.2 ANCHOR AND FASTENERS INSTALLATION

A. Auxiliary Steel Fabrication: Insofar as possible, fit and shop assemble steel fabrications and make ready for field installation.

1. Drill or punch holes as required for attachment of work and for bolted connections. Burned holes are not acceptable.
2. Perform welding of assemblies in accordance with AWS D1.1. Dress welds smooth and free of sharp edges and corners.
3. Perform shop painting of auxiliary steel as specified in Section 09900.

B. Threaded Bolts: Draw threaded bolted connections up tight using lock washers to prevent bolt or nut loosening.

C. Drilled-In Expansion Anchor and Fastener Installation:
1. General: In general, install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following:
2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
3. Minimum Embedment: Embed expansion anchors to four and one-half bolt diameters, unless otherwise indicated on Drawings.

D. Repair all damaged electro-galvanized and hot dipped galvanized surfaces.

PART 4- QUANTITY AND PAYMENT

4.1 Include all costs, equipment installation and labor for hangers and supports in the bid item “PROCESS PIPING, VALVES, FITTINGS AND APPURTENANCES, COMPLETE as provided in the Bid Form. as provided in the Bid Form. The price shall include the cost of

excavating, dewatering, laying, assembling and jointing of the pipe complete, shoring, pumping, backfilling, concrete thrust blocks, bedding, cutting, testing, concrete encasement (if shown), all materials, labor, equipment, all ductile iron, PVC and miscellaneous piping, valves, fittings, chlorine analyzers, pressure sensors, flow meters, backflow preventor, hangers supports, all assembly hardware, testing, guarantees, warranties, all hardware necessary for the installation and all else necessary for the provision of complete and operable equipment, supply and installation and all else necessary therefore and all other work in connection therewith and incidental thereto.

SECTION 400519 - DUCTILE IRON PROCESS PIPE, FITTINGS AND SPECIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile iron pipe and fittings. Furnish and install Ductile Iron Water Main and Fittings for proposed potable water distribution system complete as shown on the drawings and specified herein. Pipe shall be tested at 150 psi unless specified otherwise
   2. Accessories.

B. Related Requirements:
   1. Section 400551 "Common Requirements for Process Valves" for common product requirements for valves for placement by this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.3 SUBMITTALS

A. Contractor shall supply copies of shop drawings for all pipe and fittings for approval prior to installation.

B. Submit copies of manufacturer's certified letter stating that the pipe or joint materials ordered meets the requirements of this specification. Letter shall indicate compliance with appropriate reference standards listed.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and invert centerline elevations.

1.5 QUALITY ASSURANCE

A. Testing of Pipe - All Ductile Iron Pipe shall be tested by the manufacturer in accordance with ANSI Spec A21.51 and shall have Underwriters Laboratory approval. Manufacturer shall validate other than certification, the ductility of each length of pipe by an Underwriters Laboratory approved method.

B. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.

C. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

D. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

E. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

F. Licensed Professionals Qualifications: Professional engineer experienced in design of specified Work and licensed in New Jersey (NJ).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage of materials:
   1. Store materials to prevent physical damage.
   2. Store pipe and fittings off ground to prevent dirt and debris from entering.
   3. Store flexible gasket materials and joint primer or adhesive compounds, in cool, dry place. Keep rubber gasket clean, away from oil, grease, excessive heat, and out of direct rays of sun.

B. Handling of materials:
   1. Protect materials during transportation and installation to avoid physical damage.
   2. Do not install out-of-round pipe.
   3. Unload pipe to prevent abrasion.
   4. Do not drag or push pipe when handling or distributing on project site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

   1. The State of New Jersey (NJ) Department of Transportation standards.
   2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 DUCTILE IRON PIPE AND FITTINGS-BURIED

A. Pipe shall be as shown on plans, ductile iron pipe with push on joints conforming to AWWA

C151, minimum pressure class 350. Minimum class of pipe shall be as follows:

   1. Below 14-inch diameter: 52
   2. 14-inch diameter and above: 53

B. Fittings shall be mechanical joint cast iron or ductile iron fittings in accordance with AWWA C153 (short body) or AWWA C110 (standard). All fittings shall be bituminous lined in accordance with AWWA C104, latest edition.

C. Jointing Materials: All jointing materials shall be as furnished by manufacturer of pipe and fittings and as specified above. All jointing materials shall be in accordance with AWWA

D. C111. Cement-Mortar Lining:

1. Comply with AWWA C104.
2. Thickness: Standard.

E. Outside Coating:

1. Buried Service:

a. Type: Asphaltic.
b. Thickness: 0.04 inch

2.3 DUCTILE IRON PIPE AND FITTINGS-EXPOSED OR ENCASED UNDER STRUCTURE

A. Pipe shall be Class 53 Ductile Iron Pipe with flanged joints conforming to AWWA C115, pressure class 250.

B. Fittings shall possess flanged joints in accordance with the following:
1. For test pressures 250 psi and under: Standard per AWWA 153 (short body) or AWWA C110 (standard) rated with a working pressure of 250 psi.

2.4 For test pressures above 250 psi: Standard per AWWA C110 with special gaskets resulting in a working pressure rating of 350 psi. COATING AND LINING

A. All pipe and fittings shall be double cement lined (3” – 12” diameter, minimum 1/8” thick; 14” – 24” diameter, minimum 3/16” thick; 30” – 48” diameter, minimum 1/4” thick) under 1 Mil (0.025MM) thick of coal tar epoxy conforming to all appropriate requirements in ANSI/AWWA C104/A21.4. Flanged pipe and fittings shall also receive a 1 mil coal tar epoxy coating in the field, following installation.

B. Piping/fittings either buried or encased in concrete to shall possess a minimum 1 mil coal tar coating.

2.5 POLYETHYLANE PIPE ENCASEMENT

A. Shall be provided where shown or specified and shall be 4 mil thick cross-laminatedhigh-density polyethylene pipe wrap, Valeron Model, as manufactured by Repcor, Inc., or equal. Encasement shall be clearly marked "Water Main" every 10 LF continuously. It shall be supplied with suitable and sufficient fastening devices to be properly installed. Encasement shall meet AWWA C105.93 and ASTM D1248-89.

2.6 CONCRETE FOR TRUST BLOCKS

A. Compressive Strnght: Minimum of 4,000 psi at 28 days.

2.7 ACCESSORIES

A. Jackets:

1. Material: Polyethylene.
2. Comply with AWWA C105.
3. Double-layer, half-lapped polyethylene tape.
4. Thickness: 10 mils.

B. Gaskets Bolts and Nuts:

1. The number and size of bolts shall conform to the same American Standard as the flanges. Bolt studs and studs shall be the same quality as the bolts. Bolts and nuts for flanged and flexible joints shall be provided as follows:
   a. In an area where the pipe can be immersed (Clearwell, wet well, etc.): Type 304 stainless steel.
   b. All other areas: Conform to ASTM A307 Grade B.

C. Restrained Joints:

1. Mechanical Joints: Model F-1058 Ductile Iron Retainer Gland as manufactured by Clow Corporation or equal.
2. Push on Joints : Studs, nuts and washers shall conform to ASTM A 193, Grade B-7 or approved equal. Pipe attachment system shall be as approved by the Engineer. Restraint system for each joint shall be designed to withstand 150 percent of the system test pressure.
3. Mechanical/push on joints/couplings: As provided by National Star Products or equal.

D. Specials:

1. Taps : Provide taps where shown or required for small pipe connections. Where pipe or fitting wall thickness is such that there will not be the required number of threads, a pipe saddle shall be installed.
2. Pipe Adapters: Where necessary to join pipe of different types, Contractor shall provide necessary adapters. Ends shall conform to the specifications for the appropriate type of joint.

E. Sleeve Couplings: Smith Blair, Inc. Model # 441 or equal. Provide all exposed couplings with restraining devices. Unflanges:

1. Only permitted where approved by the Engineer. Ductile iron with 350 psi pressure rating. All exposed locations shall be provided with joint restraint at the uniflange joint.

2.8 IDENTIFICATION

A. All pipeline materials shall be stamped, marked or identified with the following:

1. Name of Manufacturer
2. Pipe Size
3. Pipe Material

4. Wall Thickness
5. Pipe Rating

2.9 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make completed piping components available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

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. Verify that field dimensions are as indicated on Drawings.

C. Inspect existing flanges for nonstandard bolt hole configurations or design, and verify that new pipe and flange mate properly.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

B. Thoroughly clean pipe and fittings before installation.

C. Surface Preparation:

1. Clean surfaces to remove loose rust, mill scale, and other foreign substances.
2. Touch up shop-primed surfaces with primer.
3. Solvent-clean surfaces that are not shop primed.

3.3 INSTALLATION

A. General - All ductile iron pipe shall be installed in accordance with the details shown on the drawings unless otherwise hereinafter specified and all excavation and backfill shall conform to the requirements hereinbefore specified.

B. Handling Ductile Iron Pipe & Accessories - All ductile iron pipe and accessories shall be new material which has at no time previously been used for any purpose whatsoever. Pipe and accessories shall be handled in such a manner to ensure delivery on the work in sound, undamaged condition and conforming in all respects to these specifications. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of any pipe or fittings at any time after the coating has been applied.

C. Placing Pipe in Trench - The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. No trench water shall be allowed to enter the pipe or fittings. At all times when work is not in progress, all open ends of pipes and fittings shall be securely closed to the satisfaction of the Engineer. Prior to recommencing pipe installation, remove plug, clean and inspect pipe.

D. Laying Pipe - The spigot shall be centered in the bell, the pipe centered home and brought into true and specified alignment. Except where necessary in making connection with other lines and as authorized by the Engineer, pipe shall be laid with the bells facing in the direction of laying, and for lines on the appreciable slope bells shall, at the direction of the Engineer, face upgrade. Under no circumstances will pipe be laid in water and no pipe shall be laid when trench conditions or the weather is unsuitable for such work, except by permission of the Engineer. When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of joint deflection shall not exceed 80 percent of the values shown on Tables 3 and 4 of AWWA C 600 – Installation of Ductile Iron Water Mains and Their Appurtenances.

E. Cutting Pipe - Cutting the pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method that will not damage the pipe lining. Unless otherwise authorized by the Engineer, all cutting of pipes shall be done by means of mechanical cutters of an approved type or types. Wheel cutters shall be used wherever practicable. Cut ends and rough edges shall be ground smooth, and for push on joint connections, the cut end shall be beveled by methods recommended by the manufacturer.

F. Mechanical Joint - Mechanical joint shall be made by accurately centering the spigot in the bell. All surfaces with which joint lubricant comes in contact shall be thoroughly cleaned by brushing with a wire brush just prior to the assembling. Brushing shall be such as to remove any foreign materials, loose rust so as to provide clean and smooth surfaces. Bolts shall be drawn by means of an indicating torque wrench and the torque applied shall be recommended for the various size bolts used and by the manufacturer of the pipe. Tightening of bolts shall be done in such a manner so that the gland is brought forward to the pipe flange evenly and kept at approximately the same distance from the flange around the entire circumference of the joint. Under no circumstances will overstressing of the bolts be permitted in order to tighten the joint, and in such case the joint shall be taken apart and reassembled after thorough cleaning.

G. All buried bolts, studs, retainer plates, nuts and washers shall be provided with two coats of bitumastic paint before backfilling.

H. No defective pipe, fittings, or other materials shall be laid or placed in the piping. Any material discovered to be defective after having been laid shall be removed and replaced with satisfactory material by the Contractor at his expense.

I. Polyethylene Pipe Encasement - The Contractor shall install enforcement around all ductile iron pipe and fittings. The Contractor shall follow all manufacturer's recommended and AWWA procedures during placement. Securely wrap encasement in such a way that all soil and groundwater shall not come in contact with pipe surface.

J. Bracing the Pipe: - All plugs, caps, tees, reducers, and bends in the piping shall be firmly wedged against the vertical face of the unexcavated trench in order to prevent the piping from being blown off the line when under pressure by means of a 1-2-4 concrete mix. Where a firm trench is not present, Contractor shall provide tie rods coated with bitumastic paint at no additional cost to the Owner. The number of joints anchored by the tie rods shall be approved by the Engineer.

K.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Inspect for damage to pipe lining or coating and for other defects that may be detrimental as determined by Engineer.
2. Repair damaged piping or provide new, undamaged pipe.
3. After installation, inspect for proper supports and interferences.

B. Pressure Testing:

1. Water: Utilize water pressure test unless indicated otherwise:
    a. All joints in pipe lines shall remain uncovered until the pipe has been subject to pressure tests. When all joints being subjected to the test are found to be tight at this pressure, in the presence of the Engineer, the test may be stopped and backfilling commenced, as hereinbefore specified. The cost of testing of the pipelines shall be borne by the Contractor who must furnish all necessary equipment, labor and materials for the tests. Pressure shall remain constant on the pipe for at least 2 hours and shall not drop more than 5 pounds nor increase more than 5 pounds in 2 hours. The maximum amount of makeup water that can be added shall be as follows:

Nominal Pipe Diameter (Inches)	Allowable Leakage per 1000 Feet of Pipe (GPH)		
	150 psi Test P	200 psi Test P	350 psi Test P
3	0.28	0.32	0.42
4	0.37	0.42	0.56
6	0.55	0.67	0.87
8	0.74	0.85	1.12
10	0.92	1.06	1.4
12	1.1	1.27	1.69
14	1.29	1.49	1.97
16	1.47	1.7	2.25

b. Acceptance shall be determined based on the amount of makeup water to be added to the pipe being tested. If any test of pipe has leakage greater than the specified amount the Contractor shall locate and make repairs as necessary until the leakage is within the specified allowance.
c. The Contractor shall test the pipeline in sections. Test pressure shall not be applied to existing water services.
d. Sections of main shall be tested before connection to existing mains. At connections to existing mains, existing static pressure shall be applied for test. No joints shall be covered until tested in presence of Engineer.

2. Conduct hydrostatic test for minimum two hours.
3. Filling:

    a. Fill section to be tested with water slowly and expel air from piping at high points.
    b. Install corporation cocks at high points.
    c. Close air vents and corporation cocks after air is expelled.
    d. Raise pressure to specified test pressure.

4. Observe joints, fittings, and valves under test.
5. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.

    a. Leakage: Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
    b. Defective joints, pipe and fittings shall be removed and replaced by the Contractor.
    c. Maintain pressure within plus or minus 5 psi of test pressure.
    d. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
    e. Compute maximum allowable leakage by following formula:

        1) L = SD x sqrt(P)/C.
        2) L = testing allowance in gph.
        3) S = length of pipe tested in feet.
        4) D = nominal diameter of pipe in inches.
        5) P = average test pressure during hydrostatic test in psig.
        6) C = 148,000.

7) If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

f. If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.

g. Correct visible leaks regardless of quantity of leakage.

3.5 CLEANING

A. Keep pipe interior clean as installation progresses.

B. After installation, clean pipe interior of soil, grit, and other debris.

PART 4 - QUANTITY AND PAYMENT

4.1 All ductile iron pipe, fittings, and all associated cost will be made as a lump sum under the line item, “PROCESS PIPING, VALVES FITTINGS AND APPURTENANCES, COMPLETE” as provided in the Bid Form. The price shall include the cost of excavating, dewatering, laying, assembling and jointing of the pipe complete, shoring, pumping, backfilling, concrete thrust blocks, bedding, cutting, testing, concrete encasement (if shown), all materials, labor, equipment, all ductile iron, PVC and miscellaneous piping, valves, fittings, chlorine analyzers, pressure sensors, flow meters, backflow preventor, hangers supports, all assembly hardware, testing, guarantees, warranties, all hardware necessary for the installation and all else necessary for the provision of complete and operable equipment, supply and installation and all else necessary therefore and all other work in connection therewith and incidental thereto.

END OF SECTION 400519

SECTION 400551 - COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valves.
2. Valve actuators.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for execution requirements for placement of concrete as required by this Section.
2. Section 260583 "Wiring Connections" for electrical connections for equipment specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with piping, equipment, and appurtenances.

1.3 SUBMITTALS

A. Product Data:

1. Valves.
2. Valve actuators.

B. Shop Drawings:

1. Indicate parts list, materials, sizes, position indicators, limit switches, actuator mounting, wiring diagrams, control system schematics.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Valve-Labeling Schedule: Indicate valve locations and nametag text.

D. Certification of Valves Larger Than 12 Inches (305 mm): Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for sizing of control valves.

F. Source Quality-Control Reports: For valves and valve actuators.

G. Field Quality-Control Reports: For valves and valve actuators.

1. Qualifications Statements: For manufacturer and licensed professional.

H. Product Certificates:

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.
3. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.

B. Valve Ends: Compatible with adjacent piping system.

C. Operation:

1. Open by turning counterclockwise close by turning clockwise.
2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

D. Valve Marking and Labeling:

1. Marking: Comply with MSS SP-25.
2. Labeling: As specified in valve schedule.

E. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.
2. Bonnets:

    a. Flanged to body and of same material and pressure rating as body.
    b. Furnish glands, packing nuts, or yokes as specified in valve Sections.

3. Stems and Stem Guides:

    a. Materials and Seals: As specified in valve Sections.
    b. Space stem guides 10 feet o.c.
    c. Submerged Stem Guides: Type 304 stainless steel.

2.3 VALVE ACTUATORS

A. Provide actuators with position indicators for shutoff valves 6 inches and larger.

B. Comply with AWWA C541and C542.

C. Provide chain actuators for shutoff valves mounted 8 feet above operating floor level.

D. Provide gear and power actuators with position indicators.

E. Valve Actuators in NEC Class I, Group D, Division 1 or 2 Hazardous Locations: UL approved.

F. Pneumatic Actuators:

1. Furnish oil lubricators, isolating valves, filter regulators, pressure gages, and condensate drains.
2. Provide local control to override automatic operation.

G. Electric Motor Actuators:

1. Control Panel:

    a. Factory mounted.
    b. NEMA 250 Type 4.
    c. Single-point power connection and grounding lug.

2. Disconnect Switch: Factory mounted in control panel.
3. Gearing:

    a. Single- or double-reduction unit.
    b. Spur or helical gears and worm gearing.
    c. Lubrication: Grease or oil in sealed housing.

H. Accessories:

1. Handwheel:

    a. Furnish permanently attached handwheel for emergency manual operation.
    b. Rotation: None during powered operation.
    c. Permanently affix directional arrow and cast OPEN or CLOSE on handwheel to indicate appropriate direction to turn handwheel.
    d. Maximum Operating Force: 60 lbf.

2.4 INSULATION

A. As specified in Section 404213 "Process Piping Insulation."

B. As indicated on Drawings on Shop Drawings in pipe schedule.

2.5 FINISHES

A. Valve Lining and Coating: Comply with AWWA C550.

B. Do not coat flange faces of valves unless otherwise specified.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

B. Owner Inspection:

1. Make completed available for inspection at manufacturer's factory prior to packaging for shipment.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

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. Verify that piping system is ready for valve installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.

B. Firmly support valves to avoid undue stresses on piping.

C. Coat studs, bolts, and nuts with anti-seizing lubricant.

D. Clean field welds of slag and splatter to provide a smooth surface.

E. Install valves with stems upright or horizontal, not inverted.

F. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.

G. Install 3/4-inch gate valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.

H. Install valves with clearance for installation of insulation and to allow access.

I. Provide access where valves and fittings are not accessible.

J. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.

K. Install insulation as indicated on Drawings or in pipe schedule.

L. Valve Applications:

1. Install shutoff and drain valves at locations as indicated on Drawings and as specified in this Section.
2. Install shutoff and isolation valves.
3. Isolate equipment, part of systems, or vertical risers as indicated on Drawings.
4. Install ball , butterfly , and gate valves in water systems for shutoff service.

3.3 FIELD QUALITY CONTROL

PART 4 - QUANTITY AND PAYMENT

4.1 No Separate payment shall be made for this idem. Include all such costs under the lump sum price “PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE” as provided in the Bid Form.

END OF SECTION 400551

SECTION 400566 – VALVES AND PIPING APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide gate valves as shown on the drawings and specified herein.

B. Provide check valves as shown on the drawings and specified herein.

C. Provide Flow control valves as shown on the drawings and specified herein

D. Provide ball valves as shown on the drawings and specified herein.

E. Install butterfly valve as shown on the drawings and specified herein

F. Provide wet tap assembly as shown on the drawings and specified herein.

G. Related Requirements:

A. Section 400551 "Common Requirements for Process Valves" for basic materials and methods related to valves commonly used for process systems.

B. Section 466112 “Granular Activated Carbon Vessels”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

A. The State of New Jersey (NJ) Department of Transportation standards.
B. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 MATERIALS

A. Buried Gate Valves

A. Shall be mechanical joint, resilient wedge iron body gate valves, AWWA, non-rising stem, open right, 2"-12" 200 psi, 14" up to 150 psi working pressure with cast iron telescopic valve boxes with cover marked "Direction of Opening". Gate valves above grade (not buried) shall be mechanical joint, resilient wedge iron body gate valves, AWWA, non-rising stem, open left, 2"-12" 200 psi, 14" up to 150 psi working pressure. Gate valves and valve boxes shall be as manufactured by Mueller Company or equal and shall conform with standards of water department of the Owner.

B. Check Valves

A. Full flow type swing check valves shall have cast iron body with flanged ends rated at 125 lbs. Valves shall be fitted with an external lever and spring mounted on the wall side of each valve. Bronze body ring shall be threaded into the valve port. Valve clapper shall be cast iron, bronze face, and shall swing completely clear of waterway when valve is full open. Hinge pin shall be of 18-8 stainless steel construction and shall be utilized with bronze bushings and O-ring seals. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve rating shall be 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Acceptable Manufacturer: Mueller Co.; Swing type check valve or approved equal.

C. Flow Control Valves

A. The Rate of Flow Control Valve shall automatically throttle and limit flow to a preset maximum rate, regardless of changing line pressure, by sensing the differential across a sized orifice plate. Flow rate is adjustable by changing the pilot set point. When differential pressure across the orifice plate is less than the pilot set-point the rate of valve opens allowing flow to meet the pre-determined demand. If differential pressure across the orifice plate exceeds the pilot set point, the rate of flow valve closes, limiting the flow to a preset maximum.

B. The main valve shall be hydraulically operated, single diaphragm actuated, globe or angle pattern. The valve shall consist of three major components; the body with seat installed, the cover with bearing installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating the operating pressure from line pressure. Packing glands, stuffing boxes and/or rolling diaphragm technology will not be permitted and there shall be no pistons operating the main valve or pilot controls. No fabrication or welding shall be used in the manufacturing process. Main valve shall comply with NSF/ANSI Standard 61 and certified lead free to NSF/ANSI 372 as a safe drinking water system component.

C. A direct factory representative shall be made available by the equipment supplier for start-up service, inspection and necessary adjustments.

D. The control valve shall be Cla-Val Model Number 40-01, or approved equal.

E. The Rate of Flow Control Valve shall be field calibrated and tested for a maximum backwash flow rate of 1,405 gallons per minute.

D. Ball Valves

A. The carbon fill and discharge valves are 4” diameter full port ball valves, 316 stainless steel construction with TFE seats and seals. A total of four (4) valves are installed, two (2) for carbon fill and two (2) for carbon discharge.

B. Utility valves for the compressed air supply will be bronze or brass or barstock brass body regular port ball valves.

C. The lime slurry chemical feed pump for feeding the lime slurry solution shall be provided with a multi-function discharge valve and a full bore stainless steel ball valves for GAC fill and Discharge.

E. Butterfly Valves

A. The process and utility piping; excluding GAC fill and discharge piping will be equipped with cast iron butterfly valves for flow control. Valves are included as standard in the system and single valves are available as Option. A total of ten (10) 8” diameter butterfly

valves will be instaslled to accommodate the process and backwash control functions. Two (2) valves are needed for backwash control, two (2) valves are needed for influent isolation, two (2) valves for effluent isolation, two (2) valve for staging of the vessels and two (2) valves for the vent function. Butterfly valves in the valve manifold shall be Pratt Model MKII or approved equal. All butterfly valves in the valve manifolds shall contain motorized actuators for automatic operation. Motorized actuators shall be EIM HQ series or approved equal.

F. Tapping sleaves and valves

A. Tapping sleeves and tapping crosses shall be mechanical joint type in accordance with the type of joint specified for water mains hereto before. Lead tipped gaskets shall be used for mechanical joints. Tapping sleeves and crosses shall have ASA 125 lb. outlet flanges. Tapping sleeves and crosses shall be as manufactured by Mueller or approved equal.

B. Tapping valves shall be of same construction as AWWA 175 lb. valves cast iron, Non-Rising Stem (NRS). Resilient wedge gate valves with inlet end 125 lb. Flange or attachments to tapping sleeves or cross end with outlet end mechanical joint with type of joint as specified hereto before for water main. Tapping sleeves shall be equipped with valve boxes as specified for valves and valve boxes hereto before. Unless otherwise directed by the Owner, the direction of opening shall be left. Tapping valves and valve boxes shall be as manufactured by Mueller or approved equal.

2.3 SOURCE QUALITY CONTROL

A. As specified in Section 400551 "Common Requirements for Process Valves."

B. Testing: Test ball valves, gate valves, butterfly valves, check valves according to AWWA C507, AWWA C509, AWWA C504, AWWA C518.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

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

3.2 INSTALLATION OF VALVES

A. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.
B. Firmly support valves to avoid undue stresses on piping.
C. Coat studs, bolts and nuts with anti-seizing lubricant.
D. Clean field welds of slag and splatter to provide a smooth surface.
E. Install valves with stems upright or horizontal, not inverted.
F. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.
G. Install valves with clearance for installation of insulation and to allow access.

H. Provide access where valves and fittings are not accessible.
I. Comply with Division 40 "Process Interconnections" for piping materials applying to various system types.
J. Retain one of the two paragraphs below.
K. Install insulation as indicated on Drawings or in pipe schedule.
L. Gate valves:

1. Handling, installation, jointing and tests shall be as specified for Water Main. All valves shall have stuffing boxes tightened if required and valves open and closed to see that all working parts are in order. Valves shall be set on blocking to ensure position while pouring and to prevent strain on connecting pipe or joints. Valve boxes shall be set directly over valve in vertical position. Fill around valve box by tamping in 8" layers. Reset valve boxes before final grading if required and clean out valve box of all foreign material so as to provide ease of operation.

M. Tapping Valves & Sleeves

1. Excavation and backfill shall be as hereto before specified. Adequate space shall be provided for installation of sleeve and tapping valve with machine. All surfaces on old pipe must be thoroughly prepared. The trench must be kept dry. Contractor shall determine exact location of existing main and other utilities before laying pipe. Tapping sleeves and crosses shall be located free of all services and joints in existing main. The complete installation including tapping sleeves and valves shall be watertight under static pressure. Only experienced personnel shall be used on the work. Any damage to existing main shall be the responsibility of the Contractor. The complete installation shall be in accordance with recommendations and directions of the manufacturer of the tapping machine used. Prior to tapping main, the Contractor and Water Superintendent shall mutually agree as to when the work shall be performed. Plugs removed from existing mains shall be delivered to water plant. The existing main shall be adequately supported during operation. Should the "cutting in" be unsuccessful through the use of tapping sleeves and crosses, Contractor shall, at no cost to Owner, furnish and install each side of the point of connection , an inserted valve under pressure as manufactured by Mueller or approved equal and make a dry connection.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

A. Test for proper alignment.
B. If specified by valve Section, field test equipment to demonstrate operation without undue noise, vibration, or overheating.
C. Engineer will witness field testing.
D. Prepare test and inspection reports.

PART 4 - QUANTITY AND PAYMENT

4.1 No Separate payment shall be made for Gate Valves, Check Valves, Butterfly Valves, Ball Valves, Flow Control Valves and Cut in Sleeves. Contractor shall include the cost for the valves and all items required for a complete installation in the lump sum bid prices “PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE” as provided in the Bid Form.

END OF SECTION 400563

SECTION 400567.13 - REDUCED-PRESSURE ZONE BACKFLOW PREVENTERS FOR PROCESS SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Reduced-pressure zone backflow preventers. Contractor shall provide all labor, materials, equipment and incidentals required to furnish one (1), new backflow preventer. The backflow preventer shall be Watts Series LF909 Reduced Pressure Zone Type, or approved equal, complete and operational with all accessories as shown on the drawings and specified herein. Work also includes providing testing and start-up services for the equipment.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of process piping.

1.3 SUBMITTALS

A. Backflow Preventer:
   1. Dimensional drawing showing plan and elevation.

B. Field testing procedures and results.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of backflow preventers.

1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer shall have a minimum of 10 years' experience in producing similar type equipment and shall show evidence of at least 5 installations with similar equipment as specified herein in satisfactory operation for at least 10 years in the continental United States.

B. Components Supply and Compatibility

   1. Obtain all equipment included in this section from a single manufacturer.

   2. Manufacturer shall prepare all shop drawings for submittals including for all components furnished under this section.

C. Reference Standards: Comply with the applicable provisions of the following standards:
   1. American Welding Society (AWS).
      a. D1.1 Structural Welding Code.

2. Hydraulic Institute: Current Standards.
3. American Society for Testing Materials (ASTM) Publications:
   a. A 36: Specifications for Structural Steel.
   b. A 48: Specification for Gray Iron Castings.
4. American National Standards Institute (ANSI):
   a. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 125.
   b. B3.15: AFBMA Standard, Load Ratings and Fatigue Life for Ball Bearings.
5. National Electric Code.
6. National Electric Manufacturers Association (NEMA) Standards:
   a. MG1.
   b. NRC.
   c. CSA.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Ship equipment, material and spare parts complete, except where partial disassembly is required by transportation regulations or for protection of components. Ship all equipment and parts to the Merchantville-Pennsauken Township.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.10 WARRANTY

A. All equipment contained within this specification shall be warranted by the manufacturer two (2) years from the date of start-up and shall include all labor, parts, travel and all other associated costs to correct the deficiency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 REDUCED-PRESSURE ZONE BACKFLOW PREVENTERS

A. Manufacturers:

B. Description:

1. Comply with ASSE 1013.
2. Configuration:

    a. Two independently operating, spring-loaded check valves.
    b. Diaphragm-type differential pressure-relief valve located between check valves.
    c. Third check valve will open under back pressure in case of diaphragm failure.

3. Materials:

    a. Body: Ductile iron.
    b. Internal Components: Stainless steel.
    c. Seal Rings: EPDM.
    d. Sensing Hose Line: Braided stainless steel.

4. Connections: Grooved, AWWA C606, Flanged, ASME B16.1, Class 125.
5. Furnish assembly with two gate valves, strainer, and four test cocks.
6. Size: 12 inches.
7. Match connecting pipes.
8. Working Temperature:

    a. Minimum: 50 deg. F.
    b. Maximum: 80 deg. F.

9. Maximum Operating Pressure: 175 psig
10. Liquid to be pumped: potable water.

C. Accessories:

1. Strainer: Wye type.
2. End Valves: Butterfly.
3. Air gap.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General:
1. Heavy-duty with stainless steel internal parts.
2. The equipment covered by these Specifications shall be of standard design, and of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as shown on the Drawings.

3. Equipment shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, and without excessive vibration or strain.

4. The units required under this section shall be complete. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.

5. .

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to manufacturer instructions and local code requirements.

B. Repair damaged coatings with material equal to original coating.

C. Do not install in vertical position.

3.4 FIELD QUALITY CONTROL

A. Following installation, inspect for interferences and proper supports.

B. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

A. Keep interior of backflow preventers clean as installation progresses.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

PART 4 - QUANTYTY AND PAYMENT

4.1 No separate payment shall be made for the backflow preventors for pressure service. Contractor shall include the cost for the items in this section required for a complete installation in the lump sum bid price “PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE” as provided in the Bid Form.

END OF SECTION 400567.13

SECTION 400567.39 - PRESSURE-RELIEF VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Weight-loaded pressure-relief valves.
2. Spring-loaded pressure-relief valves.
3. Hydrostatic pressure-relief valves.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of process tanks.

1.3 SUBMITTALS

A. Product Data:

1. Weight-loaded pressure-relief valves.
2. Spring-loaded pressure-relief valves.
3. Hydrostatic pressure-relief valves.

B. Shop Drawings:

1. Indicate materials, size, and accessories
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Source Quality-Control Reports: For pressure-relief valves.

D. Field Quality-Control Reports: For pressure-relief valves.

E. Qualifications Statement: For manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of pressure-relief valves.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantvile-Pennsauken Department of Public Works standards.

2.2 WEIGHT-LOADED PRESSURE-RELIEF VALVES

A. Description:

1. Comply with API 2000.
2. Size: 8 inches and 12 inches.
3. Configuration: Vent to flanged outlet.
4. Seat Rings: Replaceable and interchangeable.
5. Performance and Design Criteria:
   a. Maximum Leakage Rate: 1 scfh at 90 percent of set point.
   b. Maximum Pressure Setting: 2 psig.

6. Materials:

   a. Body: Ductile iron
   b. Guide Stem and Posts: Type 316 stainless steel.
   c. Weights: Lead.

7. End Connection: Flanged, ASME B16.5.

2.3 HYDROSTATIC PRESSURE-RELIEF VALVES

A. Description:

1. Size: 4 inches or 6 inches.
2. Materials:

   a. Frame and Cover: ASTM B584.
   b. Hinge Pin: Type 304 stainless steel, ASTM A276.
   c. Seat: Neoprene, ASTM D2000.

3. End Connection: Flanged, ASME B16.5.

B. Accessories:

1. Cast-iron wall sleeve with integral strainer and waterstop.
2. Flange bolts and gasket.

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

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

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Cleaning: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to manufacturer instructions and local code requirements.

B. Repair damaged coatings with material equal to original coating.

3.4 CLEANING

A. Keep interior of valves clean as installation progresses.

3.5 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

PART 4 - QUANTITY AND PAYMENT

4.1 No Separate payment shall be made for Pressure Relief Valves. Contractor shall include the cost for the items in this section in the lump sum bid price under “PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE” as provided in the Bid Form.

END OF SECTION 400567.39

SECTION 402414 - LIQUID CHLORINE AND SODIUM HYPOCHLORITE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping and tubing.
2. Valves.

B. Related Requirements:
1. Section 463341 Liquid Chemical Feed Coordination and Integration
2. Section 400551 "Common Requirements for Process Valves" for basic materials and methods related to valves as specified in this Section.

1.2 DEFINITIONS

A. PE: Polyethylene.

B. PVDF: Polyvinylidene fluoride.

1.3 SUBMITTALS

A. Product Data:

1. Piping and tubing, including pipe materials, fittings, and accessories.
2. Hangers and supports, including load capacity.
3. System components, including capacity, component sizes, rough-in requirements, and service sizes.
4. Valves, including actuators with model number and size indicated.

B. Shop Drawings:

1. Piping:

a. Indicate piping system schematic with general assembly of components and mounting and installation details.
b. Submit list of wording, symbols, letter size, and color-coding for pipe identification; comply with ASME A13.1.

2. Submit layout drawings showing piece numbers and location.
3. Valves: Submit assembly drawings indicating parts list, materials, sizes, position indicators.
4. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Field Quality-Control Reports: For piping, tubing, and valves.

D. Qualifications Statements: For manufacturer and installer.

E. Manufacturer's Approval: For installer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping and valves.

1.5 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF 61 and 372.

B. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

C. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 PIPING AND TUBING

A. PVC Piping and Tubing, Option 1:

1. Maximum Product Temperature: 140 degrees F.

2.3 VALVES

A. Materials in Contact with Chlorinated Solution: [PVC] Chlorosulfonated PE

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances Insert other specific conditions and other conditions affecting performance.

B. Verify that field dimensions are as indicated on Drawings.

C. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flanges mate properly.

D. Verify that openings are ready to receive sleeves and firestopping.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Clean surfaces to remove foreign substances.

3.3 INSTALLATION OF PIPING

A. Piping and Appurtenances:

1. As indicated on Drawings.
2. According to ASME B31.3 ASME B31.9 and manufacturer instructions.
3. In locations where pipe expansion joints are indicated, install pipe alignment guides adjacent to and within four pipe diameters of joint.
4. Field Fabrication: According to manufacturer instructions.
5. Provide flexible couplings and expansion joints at connections to equipment and where indicated on Drawings.
6. Install couplings, service saddles, and anchors according to manufacturer instructions.
7. Provide upstream and downstream clearances as indicated on Drawings and according to manufacturer instructions.
8. Local Indicators:

    a. Install direct-reading indicator devices, such as thermometers and pressure gages, to be read at floor level and accessible for maintenance and service.
    b. Install according to manufacturer instructions.

B. Valving:

1. As specified in Section 400551 "Common Requirements for Process Valves."
2. Orientate valves to permit operation and maintenance access to valve operator and to avoid interferences with other equipment.

3.4 ADJUSTING

A. Field-calibrate local indicators at time of piping installation.

PART 4 - QUANTITY AND PAYMENT

4.1 This item shall not be measured for this project. No Separate payment shall be made for this idem. Contractor shall include the cost of the liquid chlorine and sodium hypochlorite piping, and all items required for a complete installation in the unit price bid under the line item, “CHEMICAL TANKS AND FEED SYSTEMS INCLUDING INSTALLATION, COMPLETE” as provided in the Bid Form. Such price shall include but not limited to supply and installation of tanks, chemical feeds, pumps, sensors, supports, valves, appurtenances, accessories, diffusers, miscellaneous related equipment connected to the tanks, supply, install, disinfection, testing, equipment labor and all incidental thereto.

END OF SECTION 402414

SECTION 406343 - PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Programmable controllers: Provide all labor, materials, equipment and appurtenances to furnish, install, test, and make ready for operation a Programmable Logic Controller as specified herein and on the Plans.

B. Related Requirements:
   1. Section 260553 "Electrical Identification " for identification methods.

1.2 SUBMITTALS

A. Product Data: Programmable controllers.

B. The contractor shall submit to the Engineer four (4) complete sets of shop drawings, details, data sheets, and other descriptive drawings and material as may be required to fully describe the equipment proposed and to verify compliance with the contract documents.

C. All submittals shall be complete, neat, and orderly. The submittals shall also include the following, as applicable:

   1. Shop drawings pertinent to this specific application showing interconnections of the components in the system, including control logic, internal wiring detail, equipment arrangements, installation and erection details, etc.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets. Include copy of manufacturer's certified drawings.

B. Operation and Maintenance Data: Submit bound copies of operating and programming instructions, and include card replacement, adjustments, and preventive maintenance procedures and materials.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish one spare circuit card for each unique circuit card type installed.

1.5 QUALITY ASSURANCE

A. Programmable Logic Controllers provided under this Contract shall comply with the Specifications, shall be supplied from manufacturers regularly engaged in the production of such products, shall be standard products (not special order or custom-made) wherever possible, and shall be of the manufacturer's latest design.

B. This specification has been developed to establish minimum requirements for the solid-state control panels and designed to provide high reliability in industrial applications. All controllers and associated software provided under this Contract shall meet the requirements of this Specification, unless approved by the Engineer. If production of equipment is discontinued, the Contractor shall submit an alternate of comparable quality to the Engineer for approval prior to execution of Work, and at no additional cost to Owner.

1.6 FIELD CONDITIONS

A. Conform to specified service conditions during and after installation of programmable controllers.

B. Maintain area free of dirt and dust during and after installation of products.

C. Coordinate equipment, instrument, and material delivery to coincide with the Project schedule. If the delivery schedule of any equipment, instrument, or material shall affect the overall Project schedule, notify the Engineer in writing immediately. Include in the written notification documentation from the equipment Supplier indicating the revised delivery schedule and reason for the change.

D. When applicable, coordinate delivery equipment, instruments, or materials to be delivered directly to another trade or vendor for installation in a system or control panel provided under another Specification Section.

E. Exercise care while loading, unloading and transporting equipment, instruments and materials to avoid damage. Check all equipment, instruments, and materials for damage or defects within seven (7) days of delivery to the Project Site.

F. Equipment, instruments, and materials required to be stored on Site prior to installation shall be stored in such a manner to avoid damage or exposure to water, dust, or construction debris.

G. Repair or replace, at no additional cost to the Owner, all equipment, instruments and materials that are defective or damaged during installation, to the satisfaction of the Engineer.

H. Provide in accordance with Division 01 General Requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville Pennsauken Department of Public Works standards.

2.2 SYSTEM DESCRIPTION

A. Configuration: Networked programmable controller incorporated into system control panel for controlling system.

2.3 PROGRAMMABLE CONTROLLERS

A. Manufacturers:

1. Allen-Bradley/Rockwell Automation.

B. Controller conforming to NEMA 4, and with required memory and functional capacity to perform specified sequence of operation with scheduled input and output points. Provide a wall mounting type control panel of painted steel construction complete with a Allen Bradley CompactLogix Ethernet programmable controller, Allen Bradley Panelview Plus 1250 color touch screen operator interface terminal with Ethernet, Allen Bradley 9300-RADES telephone modem kit, all required nameplates, internal type THHN wire, Allen Bradley 1492-J4 terminal blocks, AC power surge protector, UL-508A label, etc, or approved equal.

C. The control panel shall be completely shop wired, tested, and finish painted prior to shipment, and shall control the system auxiliary equipment as required. The PLC shall receive input from peripheral instrumentation as required and provide automatic control of all valves, pumps, etc.

1. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. The side walls shall be open top type to permit wire changing without disconnecting.
2. A spare 120 V convenience receptacle (outlet) shall be provided.
3. Control panel shall have a Florescent light and door switch.
4. Fused control circuits shall be provided to ensure easy circuit disconnection. Each digital input and output card shall have its own fused circuit. Each fused circuit shall have its own unique wire number for the hot and common leads of the circuit. In addition, provide circuit breakers of adequate size for all instrumentation or other devices which will be powered via the control panel.
5. The power supply to the control panels shall be 120 volt, 60 Hz, 1 phase power, quantity
6. as required, with breaker size coordinated with manufacturer. A 120VAC surg suppressor shall be supplied which has an indication light to show when surge has occurred, and the unit shall have an auxiliary contact wired to the PLC as alarm fault.
7. Power to the PLC shall be powered via a UPS with sufficient capacity to allow for 20
8. minutes of continuous operation upon power failure at full load. A separate outlet shall be
9. provided for connection of the UPS power circuit to the PLC.
10. Provide Ethernet hub.

D. The Programmable Logic Controller is to be completely designed, wired, programmed and tested by the Manufacturer. The Owner / Engineer reserve the right to witness the functional test of the control panel at the manufacturer’s facility prior to shipment. The Panelview screens, at a minimum, are to contain all information for controlling and operating the Filtration System.

Various screens to depict the equipment controlled shall include, but not be limited to the following:

1. System Overview Screen,
2. Individual Filter Screens with Flow
3. Indication and Valve Position, Wash Sequencer Screen with Adjustable Timing Functions.
4. All timing and filtration control functions must be operator accessible through the Panelview touch screen.

E. Manufacturer must coordinate Filtration System Controls with the existing Plant SCADA (Supervisory Control and Data Acquisition) System. The Programmable Logic Controller will be connected to the SCADA system via cellular modems. Manufacturer must supply the fully documented Allen Bradley PLC program and Panel View programs on 3 weeks prior to system Startup.

F. Contractor shall utilize Complete Control Services, Inc., based in Egg Harbor City, NJ, to integrate the filtration system controls with the existing plant SCADA system. An allowance for $150,000 shall be provided in the bid for the same.

2.4 PREPARATION

2.5 INSTALLATION OF PROGRAMMABLE CONTROLLERS

A. Do not install products until major construction is complete and building interior is enclosed and heated.

B. Connect input and output devices as indicated on the Drawings.

C. Install engraved plastic nameplates according to Section 260553 "Electrical Identification."

D. All Programmable Logic Controllers shall be installed as shown on the Drawings and in accordance with manufacturer’s instructions and recommendations and the approved Shop Drawings.

E. All interconnecting wiring and conduit between the Programmable Logic Controller panels and electrical equipment and the existing SCADA system shall be furnished and installed in accordance with specification Division 26 "ELECTRICAL".

2.6 DEMONSTRATION AND TRAINING

A. Furnish 2 hours of instruction each for two persons, to be conducted at Project Site with manufacturer's representative.

B. Manufacturer Services: Prepare and start up programmable controller.

2.7 MAINTENANCE

A. Provide service and maintenance of programmable controllers for one year from date of Substantial Completion.

PART 3 - EXECUTION (Not Used)

PART 4 - QUANTITY AND PAYMENT

A. Filtration System Equipment

1. Payment for the supply of the Programmable Logic Controller shall be included in the lump sum bid item “GRANULAR ACTIVATED CARBON TREATMENT SYSTEM INSTALLATION, COMPLETE” as indicated in the Bid Form. The price shall include but not be limited to installation of the PLC in the new proposed building.

B. Electrical and Controls Work

1. Payment for all electrical and controls work associated with installation of the Programmable Logic Controller including electrical wiring and connections, and communication wiring required for a complete project in accordance with the drawings or as directed by the Engineer shall be made on a lump sum basis for the item “INSTRUMENTATION AND CONTROL SYSTEMS COMPLETE” as indicated in the Bid Form.

C. SCADA

1. Payment for all work associated with programming and integrating the Programmable Logic Controller shall be made on a lump sum basis for the item “ALLOWANCE FOR SCADA INTEGRATION, COMPLETE” as indicated in the Bid Form.

END OF SECTION 406343

SECTION 406600 - INSTRUMENTATION AND CONTROL EQUIPMENT

1.01 SCOPE OF WORK

A. Furnish all labor, equipment and materials required to provide complete Instrumentation and Control Equipment for the new treatment plant upgrades.

1.02 RELATED WORK

A. Refer to the following Sections and Divisions for related work:
   1. Division 11 - EQUIPMENT
   2. Division 15 - MECHANICAL
   3. Division 16 - ELECTRICAL

1.03 STANDARDS AND CODES

A. The instrumentation and control system shall conform to these Plans and Specifications, the General Specifications, and to the latest editions of the following Codes and Standards:

   1. National Electric Code (NEC), 2009 Edition.
   2. American National Standards Institute (ANSI).
   3. Occupational Safety and Health Act (OSHA).
   4. Institute of Electrical and Electronics Engineers (IEEE).
   5. National Electrical Manufacturers Association (NEMA).
   6. Electronics Industries Association (EIA).
   7. Instrument Society of America (ISA).
   8. Underwriters Laboratories – UL
   9. National Fire Protection Association – NFPA
   10. National Electrical Safety Code – NESC

1.04 SUBMITTALS

A. Provide submittals in accordance with Division 01 General Requirements.

B. Prior to submittal to the Engineer, Shop Drawings and submittal information shall be thoroughly checked by the Contractor to ensure compliance with Contract Documents. The Contractor shall be Responsible for verifying that all equipment, instruments, and materials submitted upon shall fit within available space and maintain specified physical clearances, and that all equipment is compatible with the operation of the overall system. Submittal to the Engineer of Shop Drawings and submittal information implies that the Contractor has reviewed the information, and all requirements have been satisfied.

C. Submittals and Shop Drawings shall consist of the following elements:

1. Project name, location, Project number
2. Contractor name, address
3. Table of contents or index, including equipment, instruments or materials being submitted, utilizing identification consistent with Contract Documents (equipment designation, instrument tag number, control panel name, etc.), as well as proposed, manufacturer, style/model, and part number.
4. For instrumentation submittals, provide detailed equipment submittals and logic schematic control diagram submittals in accordance with Section 01300 Submittals.
5. For control panel shop drawing submittals, refer to sections 01300 Submittals, and Section 16010 Electrical – General, for additional specific requirements.

D. The submittal information for each section shall be contained in a single submission. Incomplete or partial submissions shall not be accepted.

E. Operations and Maintenance (O&M) Materials

1. The O&M materials shall include descriptions of all equipment, the nature and intended modes of operation, testing procedures of all units in the System, and safety measures to be taken in operation. All necessary procedures and methods for effective operation of the System shall be included.
2. The O&M materials shall include record Drawings and instructions necessary for the planned maintenance of all equipment in the system. The O&M Manuals will incorporate maintenance procedures and schedules, and they will coordinate and be cross-referenced to detailed operation procedures provided by the manufacturers.
3. Information for O&M manuals shall be organized in three-ring binders, provided with labeled dividers, including a table of contents clearly describing the information included and order. Four (4) copies shall be provided to the Engineer including two flash drives with an electronic copy.
4. Include in the O&M manuals a list of local service departments, with telephone numbers, of authorized distributors for all equipment, instruments, services and appurtenances installed under this Contract. These service departments should stock the manufacturer's standard parts and equipment, provide local service options, etc.

1.05 DELIVERY, STORAGE AND HANDLING

A. Coordinate equipment, instrument, and material delivery to coincide with the Project schedule. If the delivery schedule of any equipment, instrument, or material shall affect the overall Project schedule, notify the Engineer in writing immediately. Include in the written notification documentation from the equipment Supplier indicating the revised delivery schedule and reason for the change.

B. When applicable, coordinate delivery of equipment, instruments, or materials to be delivered directly to another trade or vendor for installation in a system or control panel provided under another Specification section.

C. Exercise care while loading, unloading and transporting equipment, instruments and materials to avoid damage. Check all equipment, instruments, and materials for damage or defects within seven (7) days of delivery to the Project Site.

D. Equipment, instruments, and materials required to be stored on Site prior to installation shall be stored in such a manner to avoid damage or exposure to water, dust, or construction debris.

E. Repair or replace, at no additional cost to the Owner, all equipment, instruments and materials that are defective or damaged during installation, to the satisfaction of the Engineer.

1.06 QUALITY ASSURANCE

A. Qualifications

1. The Contractor shall have completed Work of similar or greater complexity on at least three (3) previous Projects within the last five (5) years. Successful completion shall be defined as a finished Project completed on time, without any outstanding claims or litigation involving the Contractor.
2. The Contractor shall provide, for a period of not less than twenty-four (24) months after Final Acceptance of the Project, all labor, tools, materials, and equipment necessary to address issues or defects in any system that result from faulty workmanship, installation, equipment, instruments or materials, and any resulting damage from said defects or faults, at the convenience of the Owner.
3. The Contractor shall furnish control panels fabricated by a UL 508A approved Panel Shop regularly engaged in furnishing, installing, testing and wiring similar equipment for use in water and wastewater treatment facilities and that has been in satisfactory operation for at least five (5) years.

B. Instruments, control panels and materials provided under this Contract shall comply with the Specifications, shall be supplied from manufacturers regularly engaged in the production of such products, shall be standard products (not special order or custom-made) wherever possible, and shall be of the manufacturer’s latest design.

C. Instruments, control panels, and materials supplied under this Contract shall be subject to approval by the Engineer and shall demonstrate equal appearance, quality, and performance to that specified herein. The Contractor is Responsible for verifying the availability of all equipment, instruments and materials proposed for use in the execution of this Contract prior to submission to Engineer for approval. If production of equipment, instrument, or material is discontinued, the Contractor shall submit an alternate of comparable quality to the Engineer for approval prior to execution of Work, and at no additional cost to Owner.

1.07 CONTRACTOR - RESPONSIBILITY

A. The Contractor shall perform the following general activities:

1. Selection and Evaluation of Components:

a. A SCADA System Allowance is provided in the bid form for the Contractor to obtain the services of the Owner's system integrator, Complete Control Services, Inc., Egg Harbor City, NJ, to evaluate and select the individual components of the equipment and complete interfacing to the existing plant controls. The evaluation shall be based on the specification requirements, industry standards, compatibility between components and the experience of the Contractor. Note that the Engineer shall review and approve all equipment.

2. Interfacing of Equipment:

a. The system integrator shall interface between all components within the equipment system including those components supplied by in other sections. The system integrator shall evaluate the interface between components and supply and/or modify systems to ensure compatibility.

b. The system integrator shall interface the equipment system with all field devices including those devices supplied by others. The Contractor shall evaluate the interface between components and supply and/or modify systems to ensure compatibility.

3. Interconnection and Assembly:

a. The Contractor shall obtain new Variable Frequency Drives (VFD) for the high service clearwell pumps, new magnetic flow meters for the plant influent and effluent lines and backwash water supply line, and shall perform all work required to assemble, modify, interconnect, wire, etc. as required to make all connections to the existing plant controls.

4. Coordination and Information Gathering:

a. The Contractor shall gather the required information from the equipment manufacturers, including those under other sections of these specifications, so that interfacing and integration can occur. The Contractor shall also gather any field information or operational data from the Engineer and plant operator as required to design the equipment system.

5. Miscellaneous Supplies:

    a. The Contractor shall supply any and all miscellaneous components necessary to complete the equipment system. Miscellaneous items shall include but not be limited to wiring, cable, relays, switches, enclosures, etc.
    b. Failure of these Specifications to identify a particular component necessary for the equipment system in no way relieves the Contractor from his responsibility to provide a complete and fully functional equipment system.

6. Programming:

    a. The system integrator shall provide all programming, control logic and software to monitor and operate all new instrumentation and control equipment.

7. Installation:

    a. The Contractor shall oversee the installation and field connection of the equipment system.

8. Field Tests:

    a. The Contractor shall test the installed equipment system in the field.
    b. The Contractor shall be present during the operational testing of the equipment in the presence of the Engineer and Owner.
    c. The Contractor shall be present during the start-up of the equipment to respond to any discrepancies or questions which arise.

9. Documentation:

    a. The Contractor shall provide detailed documentation for the Control System. As a minimum the following design documentation is required:

        1) Cut sheets and descriptions of all components and hardware including ratings and limitations.
        2) Wiring diagrams for all connections and controls.
        3) As-built drawings for field wiring and connections.
        4) Panel layouts.
        5) Documentation of all additions and modifications to approved System hardware and software.

    b. All documentation shall be submitted to the Engineer for review and shall become part of the Operation and Maintenance Manuals.

    c. The Contractor shall label all wires and equipment with a unique non-repeating system. The labeling identification numbers shall be included on the As-Built and interconnection drawings and shall be the same as presently used in the existing control panel wire identification system.

1.08 METHOD OF OPERATION

The new treatment systems shall be integrated into the existing instrumentation and controls. New variable frequency drives (VFDs) shall be provided and installed by the Contractor for the existing high service clearwell pumps to be upgraded as part of this project. There will be no changes to the method of operation for the existing treatment facility. Changes to the chemical feed systems shall include the relocation of post-iron sequestration and corrosion inhibiting, post-lime slurry for pH adjustment and post-chlorination for disinfection. In addition, the new Advanced Oxidation Process (AOP) treatment system including hydrogen peroxide solution feed followed by UV disinfection shall include individual control systems as provided by the treatment manufacturer, to be integrated into the existing plant SCADA system and new Human-Machine-Interface (HMI) control panel to be provided and installed by the Contractor as part of the scope of work for this project.

The method of operation of the new treatment upgrades shall be as follows. When the existing SCADA system calls for the plant to run via distribution system pressure or elevated tank level, and a well is turned on, producing water through the plant, a new programmable logic controller (PLC), to be provided and installed by the Contractor as specified in Section 406343, will signal for the pre- and post- chemical feeds pumps to start, initiating treatment of the pumped water through the plant. The new VFDs for the upgraded high service pumps will be set to automatically adjust the speed of the pump motors to maintain a constant flow through the system. When the SCADA system signals for the plant to shut off, via increased pressure in the distribution system or high elevated water tank level, the well pump will be called to shut off and the VFDs on the high service pumps will slowly ramp down speed (a field adjustable time of 0-30 secs) and when the pump motor reach a minimum output speed and flow as determined by the pump manufacturer (estimated to be 300 - 400 gpm), the high service pumps will shut off and the flow will stop through the plant. New Hand-Off-Automatic (HOA) selector switches for the high service pump controls shall be included with the VFD and wired into the controls to operate such that when in the “Automatic position”, the pumps will be called to start and stop as set forth in the automatic control circuitry. When the selector switch is in the “Hand position”, the pumps and motor will run, regardless of the automatic control circuitry and when the selector switch is in the “Off position”, the pump and motor will be shut off and not be able to run. New magnetic discharge flow meters shall be provided and installed include two (2) AOP influent line flow meters (one for each train); one (1) treatment plant effluent line flow meter; and one (1) GAC backwash water supply line flow meter, for a total of four (4) new magnetic flow meters required, as shown on the Plans. All flow meters shall be wired into the Plant PLC to provide for continuous readout. In the event the plant has been called to run and the AOP influent meter does not register flow, the a “Pump Failure” alarm will be energized, and the plant will be shut down, including all chemical feed pumps.

In addition, there will be a pH and chlorine analyzer to be provided and installed by the Contractor and located on the plant effluent line to continually measure and record plant final pH and plant effluent free chlorine residual.

1.09 ALARM CONDITIONS

A. The following additional alarm conditions and actions will be added to the existing plant operations:

Alarm Condition	Action
Plant "No Flow" Condition	If plant is called to run and the AOP influent meters (either train) registers a "no flow" condition, plant (all wells and pumping equipment) will be shut down and chemical feed pumps will be shut down and not allowed to run until the manual alarm reset switch is activated.
Low Chemical Solution Tank Level	Associated chemical feed pump is shut off, alarm condition occurs and plant is shut down and not allowed to run until the manual alarm reset switch is activated.
Low or High pH	Alarm condition occurs, plant operator is notified, plant continues to run
Low or High Free Chlorine Residual	Alarm condition occurs, plant operator is notified, plant continues to run
H_2O_2 Pump Fail	Alarm condition occurs, plant operator is notified, plant continues to run
UV Unit Fail	Alarm condition occurs, plant operator is notified, plant continues to run

B. In general, any alarm condition that shuts the well pump off will require a manual reset by the operator. All alarm conditions will be sent to the facilities main dispatch via the existing alarm control panel.

The following additional Analog Inputs will be installed on the existing PLC (by the Owner's system integrator, Complete Controls, Inc.):

4 to 20 mA signal from AOP influent flow meter
4 to 20 mA signal from plant effluent flow meter
4 to 20 mA signal from GAC backwash water supply line flow meter

The following Digital Inputs/Outputs will be installed on the PLC:

Start /Stop Chemical Feed Pumps
Chemical Feed Pumps in Hand position
Chemical Feed Pumps in Automatic position
Signal indicating Manual Alarm Reset Switch has been activated

It may be possible to combine digital input functions, such as the selector switch functions, on one digital input.

2.03 MAGNETIC FLOW METERS

A. The Contractor shall install four (4) new flanged magnetic flow meters to be located on the AOP influent line of each train (2 meters), the Plant effluent line (1 meter), and the GAC backwash water supply line (1 meter). Sizes of meters are shown on the Plans. The Magnetic Line Flow Meters shall be as specified Section 407113 – Magnetic Flow Meters. The Contractor shall provide and install all required power supply wiring and conduit for the new well discharge line flow meter transmitter, and all control wiring and conduit, including connection to the existing plant control panel. Final programming of the new flow meter signals to the control panels shall be completed by the system integrator, Complete Controls, Inc

PART 3 - EXECUTION

3.01 FIELD TESTS

A. Test the completed and installed system by demonstrating that all signals are properly received and sent and that the instrumentation and controls provided as part of this contract operate as intended in accordance with the operating requirements.

B. Adjust all timers, tuning constants, and other parameters for optimum performance under actual operating conditions.

C. Start-up testing and operational testing shall be performed in accordance with the requirements of other sections in this specification package.

PART 4 - PAYMENT

4.01 PAYMENT

A. No separate payment shall be made for the work in this section.

B. Contractor shall provide all instrumentation and control system complete as shown and specified with accessories as described herein.

END OF SECTION - 406600

SECTION 407113 - MAGNETIC FLOW METERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Magnetic flow meters.
2. Transmitters.

B. Related Requirements:

1. Section 260583 "Wiring Connections" for control power wiring requirements.

1.2 COORDINATION

A. Coordinate Work of this Section with piping Work.

1.3 SUBMITTALS

A. Product Data:

1. Magnetic flow meters.
2. Transmitters.

B. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit installation requirements and other details.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Prior to fabrication manufacturer shall submit submittal data for review and approval. Submittal data shall include shop drawings or flow meter, wiring schematics, proposed piping drawings with location of meter in relation to nearby piping, valves, and fittings. Provide certification by manufacturer that the length to bends, taps, etc are sufficient to achieve desired accuracy.

D. Testing and Calibration

1. All components will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with the operating requirements. Factory operational test shall duplicate actual performance anticipated for the complete station.
2. Certified calibration data for each meter prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

E. Operations & Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with meters, pumps, motors, piping and valves, but lack experience on exact equipment supplied.

F. Operational Test

1. Prior to acceptance by Owner, an operational test of all meter systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.5 QUALITY ASSURANCE

A. Ensure that materials of construction of wetted parts are compatible with process liquid.

B. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

C. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store equipment according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.7 WARRANTY

A. Furnish five-year manufacturer's warranty for magnetic flow meters and appurtenant devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 SYSTEM DESCRIPTION

A. Furnish sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, interconnecting cables, and unit conversions and algorithms as required for application.

2.3 MAGNETIC FLOW METERS

A. The flow meter shall be electromagnetic with flanged connections. The nominal flow meter diameter shall be based on the pipe diameter shown, that is an eight-inch (8") pipe shall be provided with a nominal eight-inch (8") meter. Four (4) flow meters shall be provided, one (1) on the effluent pipe , one (1) on the backwash influent pipe, and one (1) on each train entering the UV treatment. The meter shall consist of a flanged flow tube, flow transmitter and flow indicator. The meter shall allow signal to SCADA system.

B. The meter shall register within ±1% of the true flow of water for flows from 150-1500 gpm. Meter shall be provided with an electric transmission unit for remote instrumentation of a 4-20 mA signal proportional to flow.

C. The flow meter shall be a Krohne Optiflux Series 2000 or approved equal.

D. Output and connection to existing SCADA system shall be provided.

2.4 TRANSMITTERS

A. Transmitter Output:

1. 4- to 20-mA dc analog signal.
2. Accuracy: Plus or minus 10 percent of full scale.

B. Housing Material: Cast aluminum.

C. HMI:

1. Touch-screen programming, functioning through enclosure window without opening enclosure.
2. Display:

a. Size: Four lines by 16 characters.

b. Type: Backlit digital display.
c. User-selectable engineering units.
d. Readout of diagnostic error messages.

D. Mounting:

1. Integral or remote mounting up to <Insert> feet from flow meter.
2. Mounting Locations Less Than 4 Feet (1.2 m) above Grade: Provide stainless-steel mounting posts.

E. Transmitter Communication Interface: PROFIBUS.

F. Accessories:

1. Current signal output simulation.
2. Empty pipe detection.
3. Self-diagnostics.
4. Automatic zero adjustment.
5. Stainless-steel sunshield.
6. Signal Cable: Provided by flow meter manufacturer.

2.5 OPERATION

A. Control Power:

1. Wiring: As specified in Section 260583 "Wiring Connections."
2. 120-V ac, single phase, 60 Hz.
3. Furnish local transformers as required.

B. Enclosures: NEMA 250 Type 4 NEMA 250 Type 4X As indicated on Drawings

2.6 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of meters according to AWWA M6.

B. Owner Inspection:

1. Make completed flow meter available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Manufacture shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect flow meter and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all serial numbers and parts lists with shipping documentation. Notify the manufacturer’s representative of any unacceptable conditions noted with shipper.

3.2 INSTALLATION OF FLOW METER

A. Coordinate location and orientation of flow meter with final equipment installations.

B. Ensure that instruments are located to be easily accessible for maintenance.

C. A. Install, level, align, and connect as indicated on project drawings. Comply with manufacturer’s requirements for laminar flow noting required lengths of straight pipe prior to and immediately after flow meter. Installation must be in accordance with written instructions supplied by the manufacture at time of delivery. The flow meter shall be wired to the electrical system and existing SCADA system as required for a complete and operational system.

3.3 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by Owner, an operational test of all meter systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. A direct factory representative shall be made available for start-up service, inspection, training and necessary adjustments.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 2 hours on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment will be made for the Magnetic Flow Meters. All cost for above flow meters in accordance with the drawings or as directed by the Engineer shall be included in the lump sum price bid under “PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE” as provided in the Bid Form

END OF SECTION 407113

SECTION 407326 - GAUGE-PRESSURE TRANSMITTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Gage-pressure transmitters.

B. Related Requirements:

1. Section 260583 "Wiring Connections" for control power wiring requirements.
2. Section 466616.00 “Closed Vessel Low-Pressure-High Intensity Ultraviolet Treatment Equipment”.

1.2 COORDINATION

A. Coordinate Work of this Section with piping Work, tank Work and pump installation.

1.3 SUBMITTALS

A. Product Data: Gage-pressure transmitters, Include scale range, ratings, and calibrated performance curves for each pressure gauge, fitting, specialty and accessory specified.

B. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit installation requirements and other details.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Source Quality-Control Reports: For gage-pressure transmitters.

D. Field Quality-Control Reports: For gage-pressure transmitters.

E. Qualifications Statement: For manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and accessories.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish two spare transmitters complete with diaphragm seals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 GAGE-PRESSURE TRANSMITTERS

A. Manufacturers:

1. Dresser Industries, Inc.; Instrument Div.; Ashcroft Commercial Sales Operation.
2. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
3. Or Approved Equal

B. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type is standard. Provide liquid-filled-case type on the inlet and discharge of all pumps and as otherwise indicted onthe drawings

1. Excitation:

a. 9- to 30-V dc.
b. Overvoltage protected.

C. Case: Drawn steel, brass, or aluminum with 4-1/2-inch-diameter, glass lens.

D. Connector: Brass, NPS 1/4.

E. Scale: White-coated aluminum with permanently etched markings.

F. Range; Comply with the followings:

1. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure

2. Fluids under pressure: two times the operating pressure

G. Accuracy: Plus or minus 0.25 percent.

H. Output Signal: 4 to 20 mA dc.

I. Operating Temperature Range: Minus 40 to plus 185 degrees F.

J. Response Time: Less than 1 ms.
1. Materials: Type 316 stainless steel.
2. Location: As indicated on Drawings.

K. Mounting: Pipe.

L. Furnish cable, field preamplifiers, and signal conditioners as required to maintain accuracy from transducer to terminal device.

M. Operation:

1. Control Power:

a. Wiring: As specified in Section 260583 "Wiring Connections."
b. 120-V ac, single phase, 60 Hz.
c. Furnish local transformers as required.

2. Enclosures: NEMA 250 Type 4X and as indicated on Drawings.

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION OF GAGE-PRESSURE TRANSMITTERS

A. According to manufacturer instructions.

3.3 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 5 hours on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 No Separate payment shall be made for Gauge-Pressure Transmitters. Contractor shall include the cost for the Gauge-Pressure Transmitters and all items required for a complete installation in the unit price bid under “PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE” as provided in the Bid Form.

END OF SECTION 407326

SECTION 407513 – WATER QUALITY ANALYZERS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, and materials required to assemble, set-up, program, test and debug a complete free chlorine measuring system and pH monitoring system as shown on the Contract Documents and/or as specified herein.

B. Furnish all labor, equipment, and materials required to connect the system to the various field devices.

C. Furnish all labor, equipment, and materials required to train the Owner's personnel in the operation, maintenance, and troubleshooting of the analysis equipment and telemetry system and appurtenances.

1.02 CONTRACT RESPONSIBILITIES

A. The Contractor shall retain the services of a qualified manufacturer's representative to supervise and inspect the installation, test the system, provide training, and prepare submittals and final documentation, all as specified herein.

1.03 SUBMITTALS

Submit the following information for the water analysis and telemetry systems:

1. Catalog information, shop drawings, and descriptive literature for each component of the water analysis equipment and telemetry systems.

PART 2 – PRODUCTS

2.01 PROVIDE FREE CHLORINE MEASURING SYSTEM WITH FOLLOWING FEATURES:

A. Performance Requirements:

1. Measurement range: 0 to 5 mg/L free chlorine
2. Accuracy: ± 5 percent of reading or ± 0.035 mg/L, whichever is greater.
3. Precision: ± 5 percent of reading or ± 0.005 mg/L, whichever is greater.
4. Minimum detection limit: 0.035 mg/L.
5. Resolution: 0.01 mg/L.
6. Repeatability: 0.05 mg/L.
7. Cycle time: 2.5 minutes.

B. Environmental Requirements:

1. Sample flow rate: 0.05 to 0.13 gallon/minute
2. Sample pressure: 1 to 5 psig
3. Sample temperature: 40 to 104 degrees F
4. Operating temperature: 32 to 104 degrees F

5. Operating humidity: 90 percent at 104 degrees F maximum

C. Products

1. Acceptable Manufacturer

a. Provide Model CL17 Chlorine Analyzer by Hach Company, Loveland, CO

b. Or approved equal.

2. Manufactured Unit

a. The CL17 Chlorine Analyzer consists of a sample valve, flow cell, and buffer and indicator solutions.

b. The CL17 is housed in a NEMA 12 enclosure, IP62-rated with the gasketed door latched.

D. Equipment

1. The analyzer must be housed in a NEMA 12 enclosure that is IP62 rated with the gasketed door latched.

2. The analyzer shall be capable of measuring free or total residual chlorine by changing the tubing and indicator and buffer solutions.

3. A measurement shall be taken every 2.5 minutes and results displayed by a three-digit LCD readout in the range of 0 to 5 mg/L.

4. The analyzer must operate using 115V or 230V selectable AC power.

5. The analyzer must perform a self-test and auto-blanking between analysis points to compensate for sample color, turbidity, and changes in light intensity due to voltage fluctuations or light source aging.

6. The analyzer shall operate with an LED light source at a peak wavelength of 510nm.

7. The analyzer must be able to operate unattended for 30 days between chemical reagent changes and measurement cell cleaning.

8. The analyzer has two feed control (relay) operation modes to operate chemical feed pumps. Available control options are:

    1. On/off control where the concentration alarm outputs activate or deactivate a pump when chlorine levels fall below or exceed acceptable levels.
    2. Proportional control where the 4-20mA output current is scaled to pace a feed pump proportional to output.

9. The analyzer has standard optically isolated analog outputs, selectable as 0/4 to 20mA, field programmable over any portion of the analyzer range

10. The analyzer has two standard SPDT relay alarms, with contacts rated for 5-amp resistive loads at 230V AC power. Alarm options include concentration set point, analyzer system warning, and analyzer system shut down.

E. Components

i. Standard equipment:

1. Cl17 Free or Total Chlorine analyzer
2. One-Month Supply of reagents
3. Installation kit
4. Maintenance kit
5. Sample conditioning kit
    a. Pressure regulator, strainer, and shut off valve
6. Wall mount kit
7. User manual

ii. Dimensions 13.5 x 17.9 x 7 inches (343 x 455 x 178 mm)

iii. Weight: 16 pounds

F. The CL17 includes a standard sample conditioning element consisting of a pressure regulator, strainer, and shut-off valve.

1. Mounting
    a. The Cl17 Free or Total Chlorine analyzer can be wall mounted only.
2. Required Clearances
    a. Horizontal: 15.2 in (386 mm), 26 inches (686 mm) ideal
    b. Vertical: 19 inches (483 mm)
    c. Depth: 20 inches (508 mm)
3. Sample inlet
    a. 0.25-inch OD polyethylene tubing
4. Sample outlet
    a. 0.50-inch ID flexible tubing
5. Overflow drain
    a. 0.50-inch ID flexible tubing
6. Air purge quick connect
    a. 0.25-inch OD polyethylene tubing (optional)

G. Accessories

1. Power cord
2. Maintenance kit (1-year reagent supply)
3. Maintenance kit with pre-assembled tubing (1-year reagent supply)
4. Sample conditioning kit
5. Flow meter with 0.25-inch OD tubing
6. RS-232 output kit
7. Hach AquaTrend® network interface or approved equal

2.02 SYSTEM DESCRIPTIONPROVIDE SENSORS FOR MONITORING pH WITH THE FOLLOWING FEATURES:

A. Performance Requirements:

1. Measurement range: 0 to 14
2. Accuracy: < 0.1 pH under reference conditions
3. Temperature Range: 32°F to 221°F.
4. Flow Rate: 0 to 6.6 ft/sec.
5. Pressure Range: 0 to 100 psig @ 212°F.

B. Products

1. Acceptable Manufacturer

a. Provide Model PC2K2A pH/ORP sensor by Hach Company, Loveland, CO

b. Or approved equal.

C. Equipment

11. The pH sensor shall be available in convertible style.

12. The sensor shall have a Ryron body and shall include a PTFE double junction and Viton O-rings.

13. The pH sensor shall have a glass electrode and the ORP sensor shall have a platinum ORP electrode.

14. The pH sensor shall have a built-in Pt 1000 ohm RTD temperature element.

15. The sensor shall communicate via MODBUS RS-485 to a Hach SC200 Digital Controller

D. Components

1. Standard equipment:
   a. Sensor with integral cable
   b. User manual

2. Dimensions 5.9 x 1.3 inches

E. Accessories

2. Mounting hardware
   a. Flow through mount tees
   b. Union mount tees
   c. Insertion mount tees
3. Air/water blast cleaning washer head accessory
4. Self contained air blast cleaning system
5. pH buffer solution in 4, 7, and 10 pH strengths.
6. Interconnect cables to extend distance between sensor and analyzer

7. Junction box

2.03 PROVIDE DIGITAL CONTROLLER FOR DIGITAL SENSORS WITH THE FOLLOWING FEATURES:

A. Measurement Procedures

1. Microprocessor-based sensor controller.
2. Change digital sensors connected to the controller by unplugging and plugging in sensors as necessary.
3. Change analog sensor modules connected to the controller by unplugging and plugging analog sensor modules as necessary.
4. The controller accepts 4 different analog sensor modules in any combination to measure the following:
   a. pH/ORP module
      i. Combination pH/ORP
   b. Conductivity module
      i. Contacting conductivity
      ii. Inductive conductivity
      iii. Cationic conductivity (Calculated pH)
   c. Dissolved Oxygen/Oxygen Scavengers module
      i. Amperometric dissolved oxygen
      ii. Amperometric oxygen scavengers
   d. Analog mA IN module

B. Performance Requirements

1. pH/ORP sensor module
   a. Measurement range:
      i. pH: -2.0 to +14.0 or -2.00 to 14.00 pH
      ii. mV: -2100 to +2100 mV
   b. Repeatability: 0.1% of range or better
   c. Response time (t90%): 0.5 s
   d. Temperature range:
      i. PT100/PT1000: -20 to 200 °C
      ii. Accuracy: ±0.05 °C

C. Environmental Requirements

1. Operational Criteria
   a. Temperature -4 to 140 °F
   b. Relative Humidity 0 to 95%

D. Products

1. Acceptable Manufacturer

a. Provide Model SC200 controller manufactured by Hach Company, Loveland, CO

b. Or approved equal.

E. Manufactured Unit

A. The controller is available with the following power requirements:
1. AC powered: 100 to 240 Vac ±10%, 50/60 Hz; 15 W with 7 W sensor/network card load, 37 W
with 25 W sensor/network card load.
2. 24 VDC powered: 24 VDC, -15%, +20%; 16 W with 7 W sensor/network card load, 34 W with 25 W sensor/network card load (optional Modbus RS232/RS485 and Profibus DPV1 network connection).

B. The controller uses a menu-driven operation system.

C. The controller display is graphic dot matrix LCD with LED backlighting. D. The controller is equipped with a real-time clock.

E. The controller is equipped with two security levels.

F. The controller is equipped with a data logger with RS-232 capability. G. The controller shall have worded operation menus in 19 languages.

H. The controller is equipped with an SD card reader for data download and controller software upload.

I. Four electromechanical, UL rated, SPDT relays (Form C) are provided for user-configurable contacts rated 100 to 230 Vac, 5 Amp at 30 VDC resistive maximum.
1. The following can be programmed:
a. Alarm
b. Warning
c. Timer/scheduled cleaning
d. Feeder control
e. Event control
f. Pulse width modulation
g. Frequency modulation

2. The following can be assigned:
a. Primary value measurement I
b. Secondary value measurement I
c. Tertiary value measurement I
d. Quaternary value measurement I
e. Primary value Measurement II
f. Secondary value measurement II
g. Tertiary value measurement II
h. Quaternary value measurement II
i. Real time clock
j. Calculated values

J. Two analog 0/4-20 mA outputs are provided with a maximum impedance of 500 ohms.
1. The controller can be equipped with three additional 4-20 mA outputs with a maximum impedance of 500 ohms.

2. The following can be programmed:
a. Alarms:
1) Low alarm point
2) Low alarm point deadband
3) High alarm point
4) High alarm point deadband

5) Off delay
6) On delay

b. Controls:
1) Linear
1) Bi-linear
2) Logarithmic
3) PID

1. The following can be assigned:
a. Primary value measurement I
b. Secondary value measurement I
c. Tertiary value measurement I
d. Quaternary value measurement I
e. Primary value measurement II
f. Secondary value measurement II
g. Tertiary value measurement II
h. Quaternary value measurement II
i. Calculated values

K. The controller can be equipped with the following forms of communication:
1. MODBUS RS-232
2. MODBUS RS-485
3. Profibus DP

L. All user settings of the controller are retained for 10 years in flash memory. M. The controller is equipped with a system check for:
1. Power up test (monitoring and shutdown)
2. Total power draw
3. Memory devices
4. Temperature mother board

N. The controller has the option of graphical measurement that tracks measurement values over time.

F. Equipment

1. Materials – Polycarbonate housing, NEMA 4X enclosure, rated IP66
2. Conduit Openings – 0.5 in. NPT.

G. Components

1. Standard equipment:

a. Controller, mounting hardware for wall, pipe, and panel mounting.
b. Dimensions 5.7 x 5.7 x 7.1 inches.
c. Weight 3.5 lbs

H. Accessories

8. Weather protection shield

9. Sun screen
10. RS-232 / RS-485 MODBUS output card
11. PROFIBUS DP output card
12. HART output card
13. Additional mA input card

PART 3 – EXECUTION

3.01 INSTALLATION, FIELD QUALITY CONTROL, AND MANUFACTURER'S REPRESENTATIVE.

A. As specified in Section 11000.
B. The sensor may need to be installed with additional accessories depending on its application.
    1. Mount on rail, panel, pipe, or wall.
C. Contractor will install the analyzer in strict accordance with the manufacturer's instructions and recommendation.
D. Manufacturer's representative will include a half-day of start-up service by a factory-trained technician, if requested.
    1. Contractor will schedule a date and time for start-up.
    2. Contractor will require the following people to be present during the start-up procedure.
        a. General contractor
        b. Electrical contractor
        c. Hach Company factory trained representative
        d. Owner's personnel
        e. Engineer

PART 4 - MEASUREMENT & QUANTITY

A. No Separate payment shall be made for Water Quality Analyzers. Contractor shall include the cost for these items and all items required for a complete installation of the analyzers in the unit price bid under the line item, "PROCESS PIPING, VALVES, FITTING AND APPURTENANCES, COMPLETE" as provided in the Bid Form.

END OF SECTION 407513

SECTION 432331.23 - VERTICAL TURBINE PUMPING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vertical turbine pumps and motor assemblies
   1. Work required includes upgrading of the existing high service clearwell vertical turbine booster pumps and motor assemblies (2 required) to meet the new conditions of service as specified herein.
   2. Work also includes upgrading all electrical systems and controls to accommodate the increased horsepower rating of the upgraded vertical turbine pumping equipment.

B. Related Requirements:

   1. Section 260583 "Wiring Connections" for conduit and electrical power to pumps.
   2. Section 262923 "Variable-Frequency Motor Controllers" for execution and product requirements for equipment specified by this Section.
   3. Section 400593 "Common Motor Requirements for Process Equipment" for electric motors and accessories normally supplied as part of equipment assemblies.
   4. Section 430520 "Common Work Results for Liquid Handling Equipment" for pump components, appurtenances, and identification requirements common to liquid-handling systems.

1.2 SUBMITTALS

A. Product Data:

   1. Vertical turbine pumps and motor assemblies.
   2. Submit manufacturer information, including installation instructions, accessories, performance curves with specified operating point plotted, capacities and pressure differentials, power, rpm, sound power levels for both inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

B. Shop Drawings:

   1. Furnish diagrams showing complete layout of system, including equipment, piping, valves, wiring and ladder diagrams, controls, and control sequences.
   2. Indicate size and configuration of assembly, mountings, weights, and accessory connections.
   3. Indicate manufacturer's specified displacement tolerances for vibration at operational speed as specified for pumps.
   4. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Source Quality-Control Reports: For vertical non-clog pumps.

D. Field Quality-Control Reports: For vertical non-clog pumps.

E. Qualifications Statement: For manufacturer and installer.

F. Manufacturer's Approval: For installer.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of pumps and appurtenances.

1.4 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

B. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum five (5) years' documented experience.

C. Installers Qualifications: Company specializing in performing Work of this Section with minimum five (5) years' experience approved by the pump manufacturer. Installer shall possess a New Jersey DEP license for certified well pump and motor installations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 WARRANTY

A. Furnish two-year (minimum) manufacturer's warranty for pumps.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:
1. The Merchantville-Pennsauken Water Commission standards.
2. State of New Jersey Department of Environmental Protection standards for Safe Drinking Water Applications.

2.2 VERTICAL TURBINE PUMPS

A. Manufacturers:

1. Flowserve Corporation.

B. Pump Model: Flowserve 12EHL 5-Stage (4 existing) vertical turbine, water-lube submersible pump with 8” diameter discharge column assembly.

C. Description: Centrifugal, vertical turbine pump, with premium efficient vertically mounted hollow shaft, inverter duty rated electric motor.

D. Pump Designation:

1. Existing High Service Clearwell Booster Pump #1 located in the existing treatment building.

2. Existing High Service Clearwell Booster Pump #2 located in the existing treatment building.

E. Performance and Design Criteria:

1. Design Flow Rate (Duty Point): 1,000 GPM
2. Design Flow Total Dynamic Head (Duty Point) : 277 feet
3. Minimum Efficiency at Design Flow Rate: 84% percent.
4. Minimum Flow Rate: 420 GPM
5. Minimum Flow Total Dynamic Head: 375 Feet
6. Minimum Efficiency at Minimum Flow Rate: 52 percent.
7. Maximum Flow Rate: 1400 GPM
8. Maximum Flow Total Dynamic Head: 170 feet
9. Minimum Efficiency at Maximum Flow Rate: 74 percent.
10. Liquid Temperature: Water 55-degrees F. to 60-degrees F.
11. Maximum Pump Speed: 1785 rpm.
12. Maximum Motor Speed: 1800 rpm.

F. Casing:

1. Material: Ductile iron, ASTM A536.
2. Type: Multi-Stage
3. Connections:

    a. Flanged Bowl Assembly
    b. Threaded Column Assembly

G. Impeller:

1. Material: Stainless Steel, ASTM A276/A276M
2. Keyed to pump shaft.
3. Statically and dynamically balanced after assembly.

4. Size: 9.25 inches diameter

H. Shaft:

1. Material: Stainless Steel, ASTM A276/A276M.
2. Key couplings to shaft.
3. Furnish shaft wearing sleeve.

I. Wearing Rings:

1. Replaceable.
2. Fasteners: Type 306 stainless steel.

J. Bearings:

1. Type: Ball.
2. Minimum L-10 Life at Continuous Maximum Load and Speed: 100,000 hours.
3. Lubrication: Water lubed.

K. Operation:

1. Electrical Characteristics:

   a. As specified in Section 260583 "Wiring Connections" and Section 262923 "Variable-Frequency Motor Controllers".
   b. Horsepower: 100 HP.
   c. Voltage:480 V, three-phase, 60 Hz.
   d. Minimum Power Factor: 0.95 percent at rated load.

2. Motors:
   a. Manufacturer: US Motors
   b. Type: Vertically Mounted, Hollow Shaft
   c. Service Factor: 1.0 (1.5 on sinewave)
   d. Efficiency Level: Premium Efficient, Inverter Duty Rated
   e. Enclosure: TEFC
   f. Insulation: Class H Inverter Grade
   g. Grounding Ring: Internal AEGIS Shaft Grounding Ring
   h. Lubrication: Oil, with sight level window.
   i. Housing/Construction: Heavy Duty Cast Iron

3. Controls: New Variable Frequency Drive (VFD) controllers to replace existing pump controllers.
4. Disconnect Switch: Upgrade the existing disconnect switches, conduit and wiring as required to provide power for the increased horsepower rating of the upgraded pumps and motors.
5. Operation Sequences: Lead-Lag (no change to the existing).

L. Fabrication:

1. Connect pump shaft to drive motor with universal flexible coupling to compensate for minor misalignment and to permit removal of pump-rotating assembly and motor without removing piping.
2. Shaft Guard: Enclose shaft and universal joint with enclosed-type metal shaft guard complying with OSHA standards.
3. Pump and Drive Mating Surfaces: Machine finished.
4. Discharge Head and Column Pipe Assemblies: Reuse existing cast iron flanged discharge head, and base plate. Modify pump column assembly and pump shaft as required to accommodate installation of additional pump stages.

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make completed pump upgrades available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least 7- days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least 7-days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPS

A. According to manufacturer instructions.

B. Work to be completed: Upgrading of existing vertical turbine pumping equipment to meet new conditions of service including, but not limited to, installation of additional pump stages including bowl assemblies, shafts, column piping and new electric motors, wiring, conduit, disconnects and new VFDs.

3.2 FIELD QUALITY CONTROL

A. Inspection:

1. Ensure that pumps have been installed correctly and that there is no objectionable heat or vibration.
2. Check pump and motor alignment, proper motor rotation, and pump and drive units for proper lubrication.

B. Testing:

1. Operate pump on clear water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.
2. Verify pump performance by performing time-drawdown test or time-fill test.

3.3 ADJUSTING

A. Check control functions and adjust as required.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than two (2) full days and one additional half-day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 Include all costs for the Vertical Turbine Pumping Equipment in the lump sum price bid for the item "SUPPLY AND INSTALL HIGH SERVICE BOOSTER PUMPING EQUIPMENT AND UPGRADES" as specified herein. Price shall include the cost of all labor, materials, and equipment necessary to create a complete and functioning lime system. Work shall also include the demolition and removal of the existing equipment scheduled for replacement.

END OF SECTION 432331.23

SECTION 460553 - IDENTIFICATION FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Labels.
5. Lockout devices.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at 4400 Frosthoffer Avenue, Pennsauken Township, NJ 08109.

1.3 SUBMITTALS

A. Product Data:

1. Nameplates.
2. Tags.
3. Stencils.
4. Labels.
5. Lockout devices.

B. Shop Drawings:

1. Submit list of wording, symbols, letter size, and color coding for equipment identification and schedule, including equipment number, location, function, and manufacturer's name and model number.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualifications Statement: For manufacturer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish two containers of spray-on adhesive.

B. Tools: Furnish special crimpers and other devices required for Owner to reinstall tags.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. The Municipality of Merchantville - Pennsauken Water Commission standards.

2.2 NAMEPLATES

A. Manufacturers:

1. Craftmark Pipe Markers.
2. Kolbi Pipe Marker Co.
3. Pipemarker.com; Brimar Industries, Inc.
4. Seton Identification Products; a Brady Corporation company.

B. Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.3 TAGS

A. Plastic Tags:

1. Manufacturers:

a. Brady ID.
b. Craftmark Pipe Markers.
c. Kolbi Pipe Marker Co.
d. Marking Services, Inc.
e. R & R Identification Co.
f. Seton Identification Products; a Brady Corporation company.

2. Laminated three-layer plastic with engraved black letters on light, contrasting background color.
3. Minimum Tag Size and Configuration: 1-1/2-inch square.

B. Metal Tags:

1. Manufacturers:

a. Brady ID.
b. Craftmark Pipe Markers.

c. Kolbi Pipe Marker Co.
d. Marking Services, Inc.
e. Pipemarker.com; Brimar Industries, Inc.
f. R & R Identification Co.
g. Seton Identification Products; a Brady Corporation company.

2. Brass construction; stamped letters.
3. Minimum Tag Size and Configuration: 1-1/2-inch square with finished edges.

C. Information Tags:

1. Manufacturers:

a. Brady ID.
b. Seton Identification Products; a Brady Corporation company.

2. Clear plastic with printed CAUTION and message.
3. Minimum Tag Size: 3-1/4 by 5-5/8 inch.
4. Furnish grommet and self-locking nylon ties.

2.4 STENCILS

A. Manufacturers:

1. Kolbi Pipe Marker Co.
2. Marking Services, Inc.
3. Pipemarker.com; Brimar Industries, Inc.
4. R & R Identification Co.
5. Seton Identification Products; a Brady Corporation company.

B. Clean-cut symbols.

C. Letter Height: 1-3/4 inch.

2.5 LABELS

A. Manufacturers:

1. Brady ID.
2. Seton Identification Products; a Brady Corporation company.

B. Laminated Mylar construction.

C. Minimum Size: 1.9 by 0.75 inch.

D. Adhesive backed, with printed identification and bar code.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:

a. Brady ID.
b. Master Lock Company, LLC.

2. Anodized aluminum construction.
3. Furnish hasp with erasable label surface.
4. Minimum Size: 7-1/4 by 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION OF IDENTIFICATION

A. Identify equipment with plastic nameplates.

B. Identify inline pumps and other small devices with tags.

C. Identify control panels and major control components outside panels with plastic nameplates.

D. Apply stencil painting as specified in Section 099000 "Painting and Coating."

E. Install identifying devices after completion of coverings and painting.

F. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

G. Labels:

1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
2. For unfinished covering, apply paint primer before applying labels.

H. Install tags using corrosion-resistant chain.

PART 4 - QUANTITY AND PAYMENT

4.1 No specific payment shall be made for work under this section and all costs for said work shall be incorporated in various items in the bid proposal associated with this work.

END OF SECTION 460553

SECTION 463341 - LIQUID CHEMICAL FEED SYSTEM COORDINATION AND INTEGRATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work under this section includes providing a complete chemical feed system, including two (2) 750-gallon bulk storage tanks for sodium hypochlorite and a corrosion inhibitor, for injection at the injection points shown on the Contract Drawings. The system shall consist of a feed system composed of chemical metering pumps, piping, and appurtenances specified to feed hydrogen peroxide, sodium hypochlorite, and a corrosion inhibitor (Klenphos) into the water treatment system. All materials shall be provided in accordance with these specifications. The chemicals will be used to treat the raw water and to provide chlorine levels of 1.0 ppm and free chlorine of 0.2 ppm.

B. All components of the system shall be compatible with the conditions and chemicals to which they are subjected during the normal operation of the system. Compounds with which the materials must be compatible include, but are not limited to:

1. Hydrogen Peroxide: 3000 gal tank
2. Sodium Hypochlorite: 750 gal tank
3. Corrosion Inibitor (Klenphos); 750 gal tank
4. Lime: 1,500 gal tank

C. Section Includes:

1. Control panels.

D. Equipment and chemical feed pumps

1.2 Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for equipment bases and supports.

1.3 COORDINATION

A. The system shall provide for metering of all chemicals from the bulk storage tanks and/or drums to the appropriate areas of the water treatment plant. Three (4) storage tanks – two (2) 750-gallon tanks each for sodium hypochlorite and a corrosion inhibitor and a 3,000-gallon tank for hydrogen peroxide and a 1,500 gallon tank for the lime slurry will be required. The hydrogen peroxide tank and dosing skid, manufactured by Peabody, will be supplied as part of the Trojan UV system. See UV system specifications for more details. Chemical dosing pumps and feed lines from the tanks to the injection point(s) in the treatment process will be required.

B. Integrate instrumentation and control devices provided under other Sections.

C. Resolve signal, power, or functional incompatibilities among interfacing devices.

1.4 SUBMITTALS

A. Product Data:

1. Control panels.
2. Polymer blending and feed equipment.
3. Submit manufacturer's information with each instrument data sheet.

B. Shop Drawings:

1. Drawings showing plan and elevation views of the feed system
2. Manufacturer’s catalogue information on major system components including, but not limited to:
   a. Bulk storage tanks – for Sodium Hypochlorite & Corrosion Inhibitor
   b. Chemical Feed Pumps
3. Statement of design conditions and performance guarantee
4. Statement of warranty
5. Reference list as described in section 1.03 B
6. Symbology and Nomenclature: Comply with ISA 5.1.
7. Indicate interfaces between instruments, motor starters, control valves, variable-speed drives, flow meters, chemical feeders
8. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Data Sheets:

1. Comply with ISA 20.
2. Submit following:

   a. Manufacturer's model number or designation.
   b. Tag number as indicated on Shop Drawings.
   c. Component system or loop.
   d. Installation location.
   e. Input and output characteristics.
   f. Scale, range and units.
   g. Requirements for electric and air supply.
   h. Materials of component parts in contact with process chemicals.
   i. Special requirements or features.

D. Field Quality-Control Reports: For control panels and polymer blending and feed equipment.

1. Qualifications Statement: For system integrator.
2. System Integrator's Approval: For installer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Complete loop and schematic diagrams including field and panel wiring, piping and tubing runs, routing, mounting details, and point-to-point diagrams with cable, wire, tube, and termination numbers.

1.6 QUALITY ASSURANCE

A. Instruments Using Common Measurement Principle:

1. Furnish by single manufacturer.
2. Furnish same type, model, or class.

B. System Integrators Qualifications: Company specializing in integrating products specified in this Section with minimum three years' documented experience.

C. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by system integrator.

1.7 DELIVERY, STORAGE, AND HANDLING

A. The manufacturer shall submit complete Operation and Maintenance manuals to the Owner. These manuals shall include at a minimum:
1. Information in hazards associated with the system and the appropriate safety precautions
2. Equipment installation instruction
3. Equipment startup instructions
4. Equipment maintenance procedures
5. Troubleshooting guide
6. Individual operation and maintenance information on major system components, including but not limited to:

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 FIELD CONDITIONS

A. Panels and Enclosures: Suitable for operation in locations as indicated on Drawings.

B. Temperature Range: 32 to 104 degrees F

C. Maximum Thermal Shock: 1 degree F per minute.

D. Relative Humidity: 20 to 90 percent, noncondensing.

E. Furnish heating, cooling, and dehumidifying devices to maintain instrumentation within 20 percent of rated operating ranges.

F. Instrumentation in Hazardous Areas: Suitable for use in particular hazardous or classified location.

1.9 WARRANTY

A. The Manufacturer shall guarantee that the Chemical Feed System will perform as described in these Specifications. The Manufacturer shall warrant the system, complete, to be free from defects in materials or workmanship for a period one (1) year after installation. The Manufacturer shall repair or provide replacement for any defective components under this warranty

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA

A. Perform Work according to:

1. The State of New jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Water Commission standards.

B. Corrosion Resistance: Furnish materials resistant to corrosive attacks from process chemicals being handled.

C. Analog Signals:

1. Vary in direct linear proportion to measured variable.
2. Transient DC Voltage:

    a. Not exceeding 300 V over 1 ms.
    b. No dc component over 300 V.

3. Electrical Signals in Outside Control Panels: 4 to 20 mA dc.
4. Signals within Enclosures: 4 to 20 mA dc.
5. Isolate signals from ground.

D. Pneumatic Signals: 3 to 15 psig, with 3 psig equal to zero percent and 15 psig equal to 100 percent.

2.2 CONTROL PANELS

A. Control Wiring:

1. Material: Copper.
2. Minimum Size: No. 16 AWG.
3. Tagging:

    a. Tag control wiring at both ends with legible permanent-coded wire-marking sleeve.

b. Mark with white PVC tubing sleeves with machine-printed black marking.
c. Mark according to wire numbers as indicated on control wiring diagrams and terminal strip numbers.

B. Power Supplies:

1. Operation:

a. 115 V, plus or minus 10 percent.
b. 60 Hz, plus or minus 2 Hz.

2. Furnish power supplies for two-wire transmitters, loops for monitoring discrete inputs, and outputs.
3. Design: Minimum 130 percent of maximum simultaneous current draw.
4. Furnish power ON-OFF switch or air circuit breaker for each item requiring electrical power.
5. Mount power supplies in enclosures in field panel.

2.3 EQUIPMENT AND CHEMICAL FEED PUMPS

A. General

1. The 750-gallon bulk storage tanks shall be made from high density polyethylene (HDLPE) and shall be black or natural white in color. The tanks shall be dual walled, or double contained and be able to hold chemicals with a specific gravity of 1.9. Gasket seals must be EPDM or Viton.
2. Chemical metering pump shall be as follows:
Sodium Hypochlorite: Prominent Gamma X Series Solenoid Metering Pump
Model Number Prominent GMXA1009NPE9N000UDO1300EN

Klenphos K-300: Prominent Gamma X Series Solenoid Metering Pump
Model Number Prominent GMXA1009NPE9N000UDO1300EN

Relevant model must be NSF Certified, UL/CUL or CE approved. Output volume shall be adjustable while pumps are in operation.

3. Chemical metering pumps shall be capable of injecting solutions against pressures up to 100 psi.

B. Design

1. Control and adjustment for stroke frequency shall be means of a tactile keypad. Adjustment for stroke length shall be by means of readily accessible dial knob. A pulse indicator light shall flash green between strokes when pumping. The pump shall be equipped with an on/off button and a low-level float switch input. When the low-level sensor registers empty, the low-level indicator light shall turn red and the pump shall turn off when it registers an empty level.
2. The pump drive shall be totally enclosed with no exposed moving parts. Electronics shall be housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage.

3. The chemical pumps shall be flow paced based on effluent flow with the sodium hypochlorite pump capable of providing residual trim dosing based on chlorine analyzer feedback.

C. Material
1. Chemical metering pump housing shall be chemically resistant glass fiber reinforced thermoplastic. All exposed fasteners shall be stainless steel. Chemical metering pump valves shall be ball type, with ceramic balls. Valves shall be serviceable by replacing the cartridge valve assembly. Pump head shall be transparent acrylic material capable of resisting the pumped chemical. Fittings and connections at pump head shall be PVC.

D. Check Valves and Tubing
1. A total of 16 ft. (4.8 m) of polyethylene tubing shall be provided per pump complete with compression connections. A foot valve with integral one-piece strainer shall be provided for the suction line, and an injection/back pressure check valve with ½" NPT male connection for the injection point.

E. Control System: PLC.

F. Selector Switch: LOCAL - OFF - REMOTE.

G. Indicator Light: RUN.

H. Alarm: LOW WATER FLOW.

I. Pump:

1. Automatic.
2. Pacing Signal: 4 to 20 mA dc.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIQUID CHEMICAL FEED EQUIPMENT

A. According to manufacturer instructions.

B. Tagging:

1. Tag each component to identify its location, tag number as indicated on Drawings, and system function.
2. Provide stainless-steel tag permanently marked with tag number as indicated on Drawings.

C. Equipment Bases and Supports:

1. Material: Concrete, as specified in Section 033000 "Cast-in-Place Concrete" or as indicated on the drawings.
2. Minimum Thickness: 3-1/2 inches.
3. Length and Width: Extending 6 inches beyond supported equipment or as indicated on Drawings.

4. Anchor Bolts and Accessories: Use templates furnished with equipment.
5. Supports:

    a. Material: Steel members Formed steel channel Steel pipe and fittings.
    b. Brace and fasten with flanges bolted to equipment structure.

6. Provide rigid anchors for pipes after vibration isolation components are installed.

D. Install insulation as indicated on Drawings

E. Furnish installation certificate from device manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.2 FIELD QUALITY CONTROL

A. General: All tank fill piping and all suction piping from tank to pumps shall be provided, complete with all fittings, valves, supports, and other accessories necessary to provide a complete, operable system. These accessories shall include, but not be limited to, all components as specified herein and as shown on drawings. Discharge piping from pumps to injection point(s) shall be provided by the contractor.

B. All chemical feed piping and valve seals shall be compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the feed system. All pump suction and discharge piping shall be 3/8" I.D., 1/2" O.D. tubing.

C. All fittings shall be solvent-welded, threaded or compression-type.

D. A Wye strainer shall be provided on the suction line of each tank

E. Calibration:

1. Calibrate each instrument at 20, 40, 60, 80, and 100 percent of its span using test instruments to simulate inputs.
2. Field-calibrate instruments that were not bench-calibrated.
3. Tags: Attach calibration and testing tag to each device, signed and dated by device manufacturer's representative after calibration has been completed.

F. After installation, inspect and test for proper operation.

3.3 DEMONSTRATION

A. Demonstrate system startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel. The performance of the system shall be demonstrated to meet the requirements as set forth in these Specifications.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than five days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment. If required, Manufacturer shall make any changes to the system, at

his own expense, that may be necessary to assure satisfactory and efficient operation of this system.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

PART 4 - QUANTITY AND PAYMENT

4.1 This item shall not be measured for this project. Payment will be made for the quantity as above determined, measured in Lump Sum at the unit price bid in the Proposal for the item "CHEMICAL TANKS AND FEED SYSTEM INCLUDING INSTALLATION, COMPLETE."

END OF SECTION 463341

SECTION 463344 - PERISTALTIC METERING PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Peristaltic-type metering pumps.

B. Related Requirements:

1. Section 260583 "Wiring Connections" for execution requirements for electrical connections to pumps specified by this Section.
2. Section 460553 "Identification for Water and Wastewater Equipment" for nameplates for equipment specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with plant operations.

1.3 SEQUENCING

A. Sequence Work to prevent interference with plant operations.

1.4 SUBMITTALS

A. Product Data:

1. Peristaltic-type metering pumps.
2. Submit pump performance characteristics.
3. Submit electrical characteristics and connection requirements.
4. Submit manufacturer model number, dimensions, service sizes, and finishes.

B. Shop Drawings:

1. Submit detailed and certified dimensional Shop Drawings for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and other details.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Manufacturer's Instructions:

1. Submit detailed instructions on installation requirements, including storage and handling procedures, anchoring, and layout.
2. Submit application, selection, and hookup configuration.
3. Submit hanging and support requirements and recommendations.

D. Field Quality-Control Reports: For peristaltic-type metering pumps and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

B. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.

1.6 QUALITY ASSURANCE

A. Ensure that materials of construction on pump liquid end are compatible with chemicals listed in schedule.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept pumps on-Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store products in areas protected from weather, moisture, or possible damage.
2. Do not store products directly on ground.

C. Handle products to prevent damage to interior or exterior surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Water Commission standards.

2.2 PERISTALTIC-TYPE METERING PUMPS

A. Manufacturers:

1. EMD Millipore Corporation.
2. Omega Engineering, Inc.
3. ProMinent Fluid Controls, Inc.
4. Peabody (Supplied by Trojan)

B. Description: Self-priming peristaltic metering pump.

C. Capacity:

1. Discharge Capacity: <Insert> gph.
2. Discharge Pressure: <Insert> psig.
3. Process Fluid Viscosity: <Insert> lbf-s/sq. ft.

D. Operation:

1. Electrical Characteristics: As specified in Section 260583 "Wiring Connections"

E. Controls:

1. Adjustable settings from digital keypad
2. Flow Direction: Toggle switches.

F. Materials:

1. As recommended by manufacturer for chemical and process fluid and dosing chemical.

2.3 ACCESSORIES

A. Tubing:

1. Material:
   a. Silicone Rubber: Comply with MIL ZZ-R-765.
   b. Tygon.
   c. Norprene.

2. Size and Wall Thickness: As indicated on pipe schedule.
3. Pressure Rating: As indicated on Drawings and pipe schedule.

B. Cables: 2-foot pump connecting cable with plug and 10-foot signal input cable.

C. Calibration Column:

1. One graduated calibration column; materials of construction compatible with chemicals being used.
2. Size calibration column for two-minute run time at maximum capacity of largest pump.

PART 3 - EXECUTION

3.1 INSTALLATION OF PERISTALTIC METERING PUMPS

A. Mount pump shelf to wall with stainless-steel expansion bolts as indicated on Drawings.

B. Fasten pump to mounting shelf with stainless-steel bolts.

C. Install power and control and wiring as specified in Section 260583 "Wiring Connections"

D. Flush tubing with clean water.

3.2 FIELD QUALITY CONTROL

A. Pre-operational Check: Before operating system or components, vent air from system to ensure water in pump.

B. Startup and Performance Testing:

1. Test metering pump flow rate by measuring time to fill or by draining calibration column with potable water.
2. Operate each chemical feed system on clear water for continuous period of four hours.
3. Hydrostatically test system piping for leaks at 150 psig.

3.3 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

B. Demonstrate system control functions and alarms.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on-Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 Payment for all materials associated with the Peristaltic Metering pump in accordance with the drawings or as directed by the Engineer shall be on a lump sum basis for the item “CHEMICAL TANKS AND FEED SYSTEMS INCLUDING INSTALLATIONS, COMPLETE” as indicated in the Bid Form. Peristaltic Metering Pump Installation

END OF SECTION 463344

SECTION 463373 - LIQUID CHEMICAL DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Open-channel liquid chemical diffusers.
2. Pipeline liquid chemical diffusers.

B. Related Requirements:
1. Section 460553 "Identification for Water and Wastewater Equipment" for nameplates for equipment specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of process piping.

1.3 PREINSTALLATION MEETINGS

1.4 SUBMITTALS

A. Product Data:

1. Open-channel liquid chemical diffusers.
2. Pipeline liquid chemical diffusers.
3. Submit manufacturer information for system materials and component equipment, including performance characteristics.

B. Shop Drawings:

1. Indicate system materials and component equipment.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Field Quality-Control Reports: For liquid chemical diffusers.

D. Qualifications Statement: For manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of equipment.

1.6 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

B. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

A. Furnish five-year manufacturer's warranty for liquid chemical diffusers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.

2.2 PIPELINE LIQUID CHEMICAL DIFFUSERS

A. Manufacturers:

1. Chlorine Specialties, Inc.
2. InyoProcesss.

B. Performance and Design Criteria:

1. Capable of discharging chemical solution across diameter of pipe.
2. Process Liquid: Treated water/wastewater.
3. Flow Rate:

a. Injector: 0.002 gpm of Klenphos 300 (Corrosion Inhibitor); 0.013 gpm of Sodium Hypochlorite (Disinfection).
b. Process: 1,900 gpm.

4. Chemical Feed Pipe:

a. Size: 3/8" I.D., 1/2" O.D.
b. Material: polyethylene.

C. Mounting: Flange, Class 150.

D. Materials: PVC.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify layout, type, material, and orientation of piping connections.

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

3.2 INSTALLATION OF LIQUID CHEMICAL DIFFUSERS

A. Multiple-Orifice Diffusers: Point holes upstream.

B. According to manufacturer instructions and as indicated on Drawings.

3.3 DEMONSTRATION

A. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on Site for installation, inspection, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

B. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

C. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 Payment will be made for the quantity as above determined, measured in Lump Sum at the unit price bid in the Proposal for the item "CHEMICAL TANKS AND FEED SYSTEMS INCLUDINGINSTALLATION, COMPLETE."

END OF SECTION 463373

SECTION 463383 - LIQUID CHEMICAL FEED ACCESSORIES AND SAFETY EQUIPMENT

PART 3 - GENERAL

4.1 SUMMARY

A. Section Includes:

1. Variable-frequency motor controllers.
2. Control panels.
3. Motors.
4. Piping connections.
5. Pressure gages.
6. Safety equipment.
7. Equipment supports.
8. Insulation.
9. Finishes.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for equipment foundation pads.
2. Section 260583 "Wiring Connections" for wiring connections to equipment.
3. Section 460553 "Identification for Water and Wastewater Equipment" for nameplates, labeling, and identification methods for water and wastewater process equipment and accessories.

4.1 SUBMITTALS

A. Product Data:
1. Control panels.
2. Motors.
3. Piping connections.
4. Pressure gages.
5. Safety equipment.
6. Equipment supports.
7. Insulation.
8. Finishes.
9. Submit manufacturer information for drive assemblies, pumps, tanks, mixers, panels, and other system components.
10. Submit schematics, diagrams, panel layouts, ladder diagrams, and sequence of operation.

B. Shop Drawings:

1. Indicate assembly, foundation, and installation with location.
2. Indicate critical dimensions, sizes, and support locations.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Manufacturer Instructions: Submit special procedures and assembly of components.

D. Source Quality-Control Reports: For liquid chemical feed accessories and safety equipment.

E. Field Quality-Control Reports: For liquid chemical feed accessories and safety equipment.

F. Qualifications Statement: For manufacturer and installer.

G. Manufacturer's Approval: For installer.

4.1 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials:

1. Furnish 5 respirator filters for vapors, dusts, fumes, and mists that are likely to be present.
2. Furnish 5 gas mask canisters.

B. Tools: Furnish special wrenches and other devices required for Owner to maintain.

4.1 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with a minimum of three years' documented experience.

B. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

4.1 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

4.1 WARRANTY

A. Furnish five-year manufacturer's warranty.

PART 4 - PRODUCTS

4.1 PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Water Commission standards.

B. Corrosion Resistance: Furnish materials resistant to corrosive attacks from process chemicals being handled.

4.1 CONTROL PANELS

A. Control Panel Enclosure:

1. Furnish NEMA 4 and NEMA 12 enclosure fabricated of 10-gage steel with continuously welded seams.

    a. Enclosure door gasketed with neoprene.
    b. Heavy-duty, three-point latching mechanism.
    c. Power: 120/240 V, three phase, four wire, Y service.

2. Identify control panel components with engraved nameplate mounted on inside of panel, as specified in Section 260553 "Identification for Electrical Systems."
3. Mount components that are not mounted on front of panel on removable back panel secured to enclosure with collar studs.
4. Group, bundle, support, and route horizontally and vertically.
5. Terminate wires leaving panel at terminal strips inside enclosure.
6. Identify terminals and wires according to panel wiring diagrams, as specified in Section 260553 "Electrical Identification."
7. Furnish copper grounding plate inside control panel for terminating ground wires.

B. Transient Voltage Surge Suppressor:

1. Furnish three-phase transient voltage surge suppressor in control panel to protect panel components from potential damage from transient voltages caused by lightning or surges on incoming power line.
2. Furnish indication light to indicate unit is functioning.

C. Three-Phase Monitor:

1. Furnish three-phase monitor in control panel to monitor incoming power and sense loss of any one of three phases.
2. Inhibit equipment operation if phase loss occurs.
3. Mounting: Surface.

D. Motor-Circuit-Protector-Type Circuit Breakers:

1. Furnish molded-case circuit breaker for each starter.

2. Type: Quick make, quick break.
3. Mounting: Individual.
4. Minimum Interrupting Capacity:

    a. At 240 V: 22,000 A, rms symmetrical.
    b. At 480 V: 40,000 A, rms symmetrical.

E. Motor Starters:

1. Type: Across-the-line magnetic.
2. Rating: According to NEMA standards, sizes, and horsepower ratings.
3. Size: According to equipment motor horsepower.
4. Relays:

    a. Type: Three-pole overload.
    b. Furnish heater element in each phase of relay, sized for motor nameplate full-load amperage.

5. Furnish overload reset button for each motor starter.

F. Control Transformer:

1. Description: 120-V control transformer to provide 120-V ac control power.
2. Size: As required to power connected devices.
3. Protection: Primary and secondary fusing.

G. Circuit Breakers:

1. Type: Quick make, quick break with thermal-magnetic molded case.
2. Description: Individually mounted and identified.
3. Furnish individual circuit breakers.

H. Selector Switches: NEMA 250 Type 4X, heavy-duty, nonilluminated, maintained-contact type, with double-break silver contacts.

I. Push Buttons: NEMA 250 Type <Insert>, heavy-duty, nonilluminated, momentary-contact type, with double-break silver contacts.

J. Pilot Lights:

1. NEMA 250
2. Type: Heavy duty, transformer.

    a. Rating: 120-V ac.
    b. Color Caps: Green for RUN and red for ALARM.

3. Energization:

    a. Furnish RUN pilot light for each energized component.
    b. Energize each light through auxiliary contact on motor starter.

4. Furnish MOTOR HIGH TEMPERATURE alarm pilot light for each motor.

K. Relays:

1. Heavy-duty, general-purpose type, with 10-A contacts.
2. Terminals: Blade type that plug into socket.
3. DIN Rail: Mount to inside of panel enclosure.
4. Contact Configuration: As required for proper operation of control logic.
5. Operating Power: 120-V ac, unless otherwise indicated.
6. Furnish indicator light to indicate that relay coil is energized.

L. Terminal Blocks:

1. NEMA 250 rated for 600-V ac.
2. Identification: Permanent machine-printed marking according to terminal numbers indicated on panel wiring diagrams.
3. Furnish 20 percent spare terminal blocks in control panel.

M. Wiring:

1. Furnish control panel completely wired by manufacturer.
2. Comply with UL 508.
3. Isolate wiring and terminal blocks by voltage levels to greatest extent possible.
4. Stranded Copper, Type MTW or THHN/THWN, 600 V, and Color-Coded:

    a. Line and Load Circuits, AC Power: Black.
    b. AC Control Circuit Less Than Line Voltage: Red.
    c. DC Control Circuit: Blue.
    d. Interlock Control Circuits from External Source: Yellow.
    e. Equipment Grounding Conductor: Green.
    f. Current-Carrying Ground: White.

5. Minimum Control Wiring: No. 16 AWG, copper.
6. Tagging:

    a. Tag control wiring at both ends in control panel with legible permanent-coded wire-marking sleeve.
    b. Mark with white PVC tubing sleeves with machine-printed black marking.
    c. Mark according to wire numbers as indicated on control wiring diagrams and terminal strip numbers.

N. Nameplates:

1. Furnish laminated phenolic nameplates on front of control panel.
2. Colors: White with black engraved letters.
3. Minimum Engraving Size: ? inch.

4.1 MOTORS

A. As specified in Section 400593 "Common Motor Requirements for Process Equipment."

4.1 PIPING CONNECTIONS

A. Provide supports, anchors, and guides.

B. Flexible Connections:

1. Provide flexible connectors in piping connections to vibrating equipment.
2. Harness or anchor flexible connectors as necessary.

4.1 PRESSURE GAGES

A. As specified in Section 407313 "Pressure and Differential Pressure Gauges."

B. Size: As specified in Section 407313 "Pressure and Differential Pressure Gauges"].

4.1 SAFETY EQUIPMENT

A. Personal Protective Equipment:

1. Gloves:

a. Type: As recommended by manufacturer of chemical being handled and According to Material Safety Data Sheet (MSDS).
b. Furnish leather or metal mesh gloves for personnel handling glass products or materials that may cause a cut.
c. Cryogenic Materials: Furnish tight-fitting, insulated leather gloves.
d. Disposable Gloves for Handling Small Quantities of Chemicals: Non-reusable type, made of latex rubber, nitrile rubber, PVC, or neoprene.

2. Safety Glasses:

a. Comply with ANSI Z87.1.
b. Furnish side shields.

3. Safety Goggles:

a. Comply with ANSI Z87.1.
b. Frames: Soft vinyl material, conforming to every size face, and able to fit over prescription glasses.
c. Lens: Coated polycarbonate material to resist fogging, scratching, and damage from dust and UV rays.
d. Furnish heavy-duty carrying case.

4. Respirators:

a. Type: Full face.
b. Description: Soft silicone face piece with wraparound polycarbonate lens with minimum 200-degree field of vision.
c. Lens: Impact resistant and complying with ANSI Z87.1.
d. Furnish ultistrip head harness, nose cup, and speaking diaphragm.

e. Furnish filter suitable for vapors, dusts, fumes and mists that are likely to be present.
f. Furnished storage cabinet with adjustable shelves for storing respirator, cartridges, filters, and accessories.

5. Disposable Particulate Respirators:

a. Description: Lightweight, moisture-resistant filter media with adjustable nose piece and foam seal conforming to facial contours.
b. Furnish manufacturer's standard package of multiple quantities of disposable respirators.

6. Gas Masks:

a. Description: Distortion-free face piece, adjustable universal harness, and crush-proof breathing tube, all contained within a water-resistant equipment pouch.
b. Canisters:

1) Furnish two canisters in a hard-shell case.
2) Capable of filtering hydrogen sulfide, chlorine, phosphine, organic vapor, dust, and mists.

7. Equipment Cabinets:

a. Adequate for storage of personal protective equipment, as indicated on Drawings, and clearly labeled as SAFETY EQUIPMENT.
b. Number and Locations: As directed by Engineer and as indicated on Drawings.

B. Emergency Showers:

1. Manufacturers:

a. Acorn Safety; a Division of Morris Group International.
b. Bradley Corporation.
c. Chicago Faucets; Geberit Company.
d. Encon Safety Products.
e. Guardian Equipment Co.
f. Haws Corporation.
g. Sellstrom Manufacturing Company.
h. Speakman Company.
i. WaterSaver Faucet Co.

2. Comply with ANSI Z358.1.
3. Shower Head:

a. Description: Self-cleaning and non-clogging.
b. Type: Drench.
c. Mounting: Wall.
d. Material: Stainless steel, Copper alloy or Plastic.
e. Diameter: 8 inches.

4. Furnish elbow, pipe pedestal with floor flange, and instant-action stay-open valve actuated by rigid stainless-steel pull rod.
5. Furnish emergency signage as recommended by manufacturer.
6. Finish: Corrosion-resistant coating.

C. Emergency Eye and Face Washers:

1. Manufacturers:

a. Acorn Safety; a Division of Morris Group International.
b. Bradley Corporation.
c. Chicago Faucets; Geberit Company.
d. Encon Safety Products.
e. Guardian Equipment Co.
f. Haws Corporation.
g. Sellstrom Manufacturing Company.
h. Speakman Company.
i. WaterSaver Faucet Co.

2. Comply with ANSI Z358.1.
3. Mounting: Wall.
4. Bowl: Plastic or Stainless steel, with elbow.
5. Pedestal:

6. Valve:

a. Type: Instant action, stay open.
b. Actuation: Push flag.

4.1 EQUIPMENT SUPPORTS

A. Support and anchor chemical feed equipment and piping on concrete pads as specified in Section 033000 "Cast-in-Place Concrete."

B. Fabricated Metal Supports Exposed to Chemical Spillage:

1. Type 316 stainless steel or enameled steel.
2. Anchor Bolts, Nuts, and Washers: Type 316 stainless steel.

4.1 INSULATION

A. Piping Insulation: As specified in Section 404213 "Process Piping Insulation."

B. Equipment Insulation: As specified in Section 404223 "Process Equipment Insulation."

4.1 FINISHES

A. Machine Finish: Comply with ASME B46.1.

B. Coat equipment as specified in Section 099000 "Painting and Coating" and according to manufacturer's recommended coating for service conditions.

4.1 SOURCE QUALITY CONTROL

A. Control Panel:

1. Perform factory test of completed control panel by demonstrating operation of control functions, and provide certified test results.
2. Factory assemble and test each control and alarm function.
3. Test sequence of operation.

B. Owner Inspection:

1. Make completed control panel available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 5 - EXECUTION

4.1 EXAMINATION

A. Verify that designated areas, clearances, structural requirements, piping, utility connections, and electronic signals are ready to receive equipment.

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

4.1 PREPARATION

A. Disconnect electrical systems scheduled for removal.

B. Provide temporary wiring and connections to maintain existing systems in service during construction.

C. Remove, relocate, and extend existing installations as necessary to accommodate new construction.

4.1 INSTALLATION OF LIQUID CHEMICAL FEED ACCESSORIES AND SAFETY EQUIPMENT

A. According to manufacturer instructions.

B. Equipment Bases and Supports:

1. Material: Concrete, as specified in Section 033000 "Cast-in-Place Concrete" and indicated on Drawings.
2. Minimum Thickness: 3-1/2 inches.
3. Length and Width: Extending 6 inches beyond supported equipment and as indicated on Drawings.
4. Anchor Bolts and Accessories: Use templates furnished with equipment.
5. Supports:

a. Material: Steel members.
b. Brace and fasten with flanges bolted to equipment structure.

6. Provide rigid anchors for pipes after vibration isolation components are installed.

C. Install insulation as indicated on Drawings and as specified in Section 404213 "Process Piping Insulation".

4.1 FIELD QUALITY CONTROL

A. Inspect for proper alignment.

B. Testing:

1. Demonstrate operation without undue noise, vibration, or overheating.
2. Engineer will witness field testing.
3. Control Systems:

a. Start control system by energizing equipment and test operation of hardware and process control logic under supervision of manufacturer's representative and in presence of Engineer.

4.1 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

B. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 – QUANTITY AND PAYMENT

4.1 Liquid Chemical Feed Accessories and Safety equipment

A. Payment will be made for the quantity as above determined, measured in Lump Sum at the unit price bid in the Proposal for the item "CHEMICAL TANKS AND FEED SYSTEMS INCLUDING INSTALLATION, COMPLETE."

END OF SECTION 463383

SECTION 463643 - LIME SLURRY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Lime slurry. The Scope of Work shall include furnishing all labor, materials, equipment and appurtenances necessary to replace the existing lime slurry system complete as shown on the plans and specified herein.

B. Related Requirements:
   1. Section 460553 "Identification for Water and Wastewater Equipment" for nameplates for equipment specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with Work of other Sections.

1.3 SUBMITTALS

A. Product Data:

   1. Lime slurry.
   2. Submit manufacturer product data for system materials and component equipment, including electrical characteristics.

B. Shop Drawings:

   1. Indicate system materials and component equipment.
   2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.
   3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Source Quality-Control Reports: For lime slurry and appurtenances.

D. Field Quality-Control Reports: For lime slurry and appurtenances.

E. Qualifications Statements: For manufacturer and installer.

F. Manufacturer's Approval: For installer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of installed lime slurry equipment.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools: Furnish special wrenches and other devices required for Owner to maintain and calibrate equipment.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

A. Furnish five year manufacturer's warranty for lime slurry equipment and accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Water Commission standards.

2.2 LIME SLURRY MIXER

A. Manufacturers:

1. Mixtec
2. Prominent

B. Lime Slurry Mixer:

1. Contractor shall furnish and install one (1) mixer designed to maintain a completely mixed 10 percent lime slurry solution. Mixer shall be Mixtec Model 2000 or approved equal. The mixer shall consist of an electric motor, high speed flexible coupling, gear drive and bearing housing, impeller shaft and single propeller. The contractor shall provide stainless steel hardware for mounting the mixer to the lime tank.

2. Housing: The housing shall be designed with sufficient wall thickness to support the radial and axial loads transferred from the impeller and shaft. The housing material of construction shall be 304 SS. The gear housing and bearing housing shall be one-piece integral construction. Pertinent information shall be stamped into a stainless-steel nameplate and permanently mounted on the housing surface.

3. High Speed Coupling: The gear drive mixer will be flexibly coupled to the motor. The flexible coupling will protect the motor from radial and axial loads of the mixer shaft and gears. The coupling will provide torsion shock load protection.

4. Speed Reducer Gears: The speed reduction shall be made with inline concentric planetary gears of 5:1 nominal ratio. These gears will be designed for 24 hour per day mixer duty service with an AGMA service factor of 1.5 or greater. Gears shall be lubricated with lifetime synthetic grease. Anti rotation pins are positioned with sufficient float to allow the ring gear to self-center

5. Bearings: Shaft bearings shall be ball type and sealed for life. The AFBMA bearing life to be 100,000 hours or greater when rated at the design speed and motor horsepower. Oil seals will be provided on both bearings for the gear reduced mixer.

6. Beam Mount: The mixer will be supplied with a pedestal that allows for mounting to a beam or channel base.

7. Motor: The motor shall be a 2 HP, 1750 RPM, TEFC IP55 Washdown Duty, Inverter Ready 10:1 turndown motor with a 1.15 for 230/460V, 60 Hz, 3 Ph electrical service. Motor ball bearings will be permanently lubricated, double sealed and mechanically or chemically clamped. Insulation shall be class F minimum.

8. Shaft Attachment: The shaft shall be attached to the mixer by a hollow quill chuck. The chuck shall be constructed to allow access to the release screw without removal of plates. The shaft shall have a reverse taper for secure shaft hold in the event of the loosening of the chuck screw.

9. Shaft: The shaft shall measure 1.25” in diameter and extend approximately 66” as measured from the mixer mounting base. The shaft shall be of centerless ground construction and finished for straightness and cleanliness. The material of construction shall be 316L stainless steel. The total indicated shaft run out (TIR) should be less than 2 millimeters per meter of shaft length when turned by hand. Contractor shall confirm actual shaft length based upon final tank design and dimensions.

10. Impellers: The mixer will be provided with a single 24" diameter propeller with stabilizing ring for operation at 350 RPM at full motor speed. The material of construction will be 316L stainless steel. Impellers will be set screwed or welded to the shaft.

C. Lime Slurry Feed Pumps

The contractor shall furnish and install one (1) chemical feed pump for feeding the lime slurry solution. The lime feeder pump shall be Prominent Sigma 3 diaphragm pump Model Number S3CBH120145SSTS080UD010S1EN or approved equal. The unit shall be supplied with PVC suction and polyethylene discharge tubing and valves of sufficient quantity for the complete operation of this system as shown on the plans. The pump shall be installed on the new tank.

1. The unit shall successfully deliver a capacity of 25 GPH of lime slurry against a minimum 130-psig back-pressure at the injection point.

2. The pump shall be provided with the following:
   a. A multi-function discharge valve that provides the following: Back pressure/anti-siphon, pressure relief, priming aid and discharge line vent.
   b. Stainless steel ball valves.
   c. One (1) set of preventative maintenance kits.

3. The lime slurry pump shall be provided with an automatic slurry flushing system. All piping, conduit, conductors and control logic associated with this system shall be provided.

4. Manual air bleeds on discharge side of pump shall be provided. Air bleeds shall consist of 1/4 turn ball valve with piping to extend to floor.

5. Provide unions before & after the pump and where shown on the Lime Slurry System Schematic Drawing.

D. Lime Slurry Mix Tanks

1. Furnish and install one (1) fifteen hundred (1500) gallon (approximate) 304 SS tank suitable for handling a lime slurry. Tank shall be six feet and six inches (6'-6") in diameter by 59" sidewall height.

2. The tank shall be equipped with a hinged cover, a two (2) inch drain, a suitable opening in the tank lid for the mixer shaft, a two (2) inch diameter suction line hole in the tank lid with Schedule 80 PVC stilling wells for the pump suction lines, one (1) two (2) inch diameter hole in the tank lid for the tank makeup water fill and one (1) three (3) inch coupling for dust collector.

3. Tank to be fitted with four (4) baffles located at 90 degree increments. The tank shall also have two (2) lifting lugs.

4. The tank shall be leg supported via angle legs with suitable bottom pads. Contractor shall provide stainless steel hardware for the tank installation.

5. The tank shall be equipped with a dished (domed shaped) bottom. The two (2) inch N.P.T. drain connection at the bottom of the dish bottom shall be fitted with a 90 degree elbow and shut-off valve.

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of lime sllurry equipment.

B. Owner Inspection:

1. Make completed gravity belt thickener available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.
3. .

C. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that facility, piping, and electrical Work are ready to receive lime slurry equipment.

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

3.2 INSTALLATION OF LIME SLURRY

A. According to manufacturer instructions.

3.3 FIELD QUALITY CONTROL

A. Inspect for proper operation.

B. Testing:

1. Functional Testing: Prior to system startup, inspect components for proper alignment, proper connection, and acceptable operation.

3.4 ADJUSTING

A. Check control functions and adjust as required.

3.5 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

B. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

C. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 Include all costs for the lime slurry system and related appurtenances in the lump sum price bid for the item "CHEMICAL TANKS AND FEED SYSTEM INCLUDING INSTALLATION, COMPLETE" as specified herein. Price shall include the cost of all labor, materials, and equipment necessary to create a complete and functioning lime system. Work shall also include the demolition and removal of the existing lime system equipment scheduled for replacement.

END OF SECTION 463643

SECTION 464117 - INLINE STATIC MIXERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Inline static mixers.

B. Related Requirements:
   1. Section 400523 "Ductile Iron Process Pipe" for piping connections as specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of process piping.

1.3 SUBMITTALS

A. Product Data:

   1. Inline static mixers.
   2. Submit manufacturer information, including system materials, component equipment, and performance characteristics.

B. Shop Drawings:

   1. Submit dimensional drawings and details.
   2. Indicate schedule of equipment components.
   3. Indicate materials of construction.
   4. Indicate installation requirements, including fasteners and other details.
   5. Indicate mounting details.
   6. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Source Quality-Control Reports: For inline static mixers.

D. Field Quality-Control Reports: For inline static mixers.

E. Qualifications Statements: For manufacturer and installer.

F. Manufacturer's Approval: For installer.

1.4 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and 372.

B. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

C. Installers Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 WARRANTY

A. Furnish five -year manufacturer's warranty for static mixers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:
1. The Municipality of Merchantville- Pennsauken Water Commission standards.

2.2 INLINE STATIC MIXERS

A. Manufacturers:

1. Komax Systems, Inc.
2. Koflo Corporation.

B. Description: Fixed arrangement of stationary baffles enclosed in a pipeline.

C. Performance and Design Criteria:

1. Pipe Diameter: 12 inches.
2. Number of Elements: 1.
3. Length: 48 inches.
4. Maximum Working Pressure at 75 Degrees F: 150 psig.
5. Nominal Flow Rate: 1,900 gpm.
6. Pressure Loss: <Insert> psi.

D. Materials:

1. Housing:

a. Stainless Steel:

1) Comply with ASTM A312/A312M.
2) Type 316L.

2. Elements: Stainless steel; Type.
3. Connections:
a. Stainless Steel: As specified in 400523 "Stainless Steel Process Pipe and Tubing."

E. Finishes:

1. Internal Coating: None
2. External Coating: None

2.3 ACCESSORIES

A. Chemical Injection Port: Female threaded.

B. Flow-straightening vanes.

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make completed static mixer available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

C. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Shop Drawings.

B. Inspect existing flanges for nonstandard bolt-hole configurations or design and verify that static mixer and flange mate properly.

3.2 INSTALLATION OF INLINE STATIC MIXERS

A. According to manufacturer instructions.

3.3 DEMONSTRATION

A. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

B. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 No separate payment shall be made for the Inline Static Mixers. The Contractor shall include all costs for the this item and related appurtenances required for a complete installation in the lump sum price bid for the item "ADVANCED OXIDATION PROCESS INCLUDING HYDROGEN PEROXIDE FEED SYSTEM AND UV DISINFECTION SYSTEM, COMPLETE" as specified herein. Price shall include the cost of all labor, materials, and equipment necessary to create a complete and functioning system.

END OF SECTION 464117

SECTION 464123 - SUBMERSIBLE MIXERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Submersible propeller mixers.

B. Related Requirements:
   1. Section 260583 "Wiring Connections" for wiring connections to equipment.
   2. Section 460553 "Identification for Water and Wastewater Equipment" for nameplates for equipment specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of process piping and installation of tanks.

1.3 SUBMITTALS

A. Product Data:

   1. Submersible propeller mixers.
   2. Submit manufacturer's Product Data for system materials and component equipment, including performance characteristics.
   3. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

B. Shop Drawings:

   1. Indicate system materials and component equipment, including electrical characteristics.
   2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.
   3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Manufacturer's Certificate:

   1. Certify that mixers meet or exceed specified requirements.
   2. Certify installation is completed according to manufacturer's instructions and that mixers have been properly installed and tested and are ready for operation.

D. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for required thrust, blade configuration and power requirements.

E. Source Quality-Control Reports: For submersible propeller mixers.

F. Field Quality-Control Reports: For submersible propeller mixers.

G. Qualifications Statements: For manufacturer and licensed professional.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and final orientation of mixers.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools: Furnish special wrenches and other devices required for Owner to maintain and calibrate equipment.

1.6 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Comply with NSF Standard 61 and NSF Standard 372.

B. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

C. Licensed Professionals Qualifications: Professional engineer experienced in design of specified Work and licensed in the State of New Jersey (NJ).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging including application instructions.

B. Inspection: Accept mixers on-Site in original packaging and inspect for damage.

C. Store mixers according to manufacturer's instructions.

D. Protect mixers from water and wet weather.

1.8 WARRANTY

A. Furnish five-year manufacturer's warranty for mixers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey (NJ) Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Water Commission standards.

2.2 SUBMERSIBLE PROPELLER MIXERS

A. Manufacturers:
   1. Mixtec

B. Performance and Design Criteria:

   1. Tank Volume: 1500 gal.
   2. Tank Geometry: As indicated on Drawings.
   3. Maximum Working Temperature: 200 degrees F.
   4. Mounting: Flanged, threaded, female, quick release, as indicated on Drawings.
   5. Lubrication: Self-lubricating with mixing fluid or Nontoxic oil.

C. Shaft:

   1. Motor Shaft and Rotor: Single integral unit.
   2. Material: Type 316 stainless steel.
   3. Seals: Mechanical.

D. Bearings:

   1. Ball Bearings:

      a. Comply with ABMA 9.
      b. L-10 Life: 100,000 hours.

   2. Roller Bearings:

      a. Comply with ABMA 11.
      b. L-10 Life: 100,000hours.

E. Materials:

   1. Blades: Type 316 stainless steel.
   2. Mixer: Type 304 stainless steel.

F. Accessories:

   1. Guide Bar System:

      a. As recommended by manufacturer for mixer assembly.
      b. Materials: Compatible with process liquid.
      c. Depth: As indicated on Drawings.

   2. Lifting Mechanism:
      a. Stainless Steel Cable.

   3. Davit Crane: Hand-winch operation.

4. Fasteners: Series 300 stainless steel.

G. Operation:

1. Electrical Characteristics: As specified in Section 260583 "Wiring Connections" and following:

a. 2 hp; 1750 RLA.
b. Voltage: 230/460 V, three phase, 60 Hz.

2. Motors: As specified in Section 400593 "Common Motor Requirements for Process Equipment.'
3. Control Panel:

a. Factory mounted.
b. NEMA 4.
c. Single-point power connection and grounding lug.

4. Controls: Three stator thermal switches.
5. Disconnect Switch: Factory-mounted in control panel.

2.3 SOURCE QUALITY CONTROL

A. Owner Inspection: Make completed jet mixers available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify layout, type, and orientation of piping connections.

B. Verify that tank configuration will accommodate mixer, piping, and accessories.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SUBMERSIBLE MIXERS

A. Install equipment according to manufacturer's instructions.

3.3 DEMONSTRATION

A. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than five days on-Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

B. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

C. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 - QUANTITY AND PAYMENT

4.1 Include all costs for the submersible mixers system and related appurtenances in the lump sum price bid for the item "CHEMICAL TANKS AND FEED SYSTEMS INCLUDING INSTALLATION, COMPLETE" as specified herein. Price shall include the cost of all labor, materials, and equipment necessary to create a complete and functioning system.

END OF SECTION 464123

SECTION 466111 – GRANULAR ACTIVATED CARBON VESSELS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Relocate two (2) granular activated carbon (GAC) systems composed of two (2) single adsorption vessels each, complete with GAC media, as shown on the drawings and specified herein. A total of four (4) vessels shall be removed from the existing location (concrete pads) and reinstalled in the proposed buildings as shown on the plans.

B. Vessels shall be reinstalled complete with valve manifolds from the Owner.

C. As required by the NJDEP, all materials which come into contact with the water supply shall meet NSF 61 standards, including but not limited to GAC vessels, GAC media, piping, coatings/linings, valves, gaskets, and expansion joints. It is acceptable to have NSF 61 certification for the GAC system in its entirety (as a total package system), in lieu of components being certified individually.

D. Single adsorption vessels shall be Model 12-40 DWC Adsorption System furnished by Calgon Carbon Corporation, or approved equal, as described herein. The complete adsorption system includes the following.

a. Carbon adsorber with internals for carbon retention
b. Activated Carbon
c. Influent and effluent piping. Backwash inlet and outlet to include a blind flange.
d. Carbon fill and discharge piping with valves
e. Vent and pressure relief piping
f. Water piping and utility connections
g. Accessories as shown below
h. Manufacturer's Services

E. There will be two (2) Model 12-40 DWC carbon adsorption systems, or approved equal, as delineated below:

System Number	Quantity of Model 10 System	Quantity of Carbon Vessels	System Flow Rate GPM (EBCT –minutes)	Pressure Drop – Normal Operation PSI
2	Zero (0)	Four (4)	1000 gpm	~ 7 (?)

PART 2 – PRODUCTS

2.01 General

A. The Contract Documents indicate specific required features of the equipment, but do not purport to cover all details of design and construction.

2.02 Carbon Adsorber Vessels

A. The carbon adsorber shall be a Model 12-40 DWC Adsorption Vessels, as designed by Calgon Carbon Corporation, or approved equal, to meet the following specifications.

B. The carbon adsorber vessel is fabricated of carbon steel, conforming to ASTM A516 grade 70, 12'-0" diameter by 16'- 0" straight side height with 2:1 elliptical top and bottom heads. Each vessel will be sized to contain 40,000 pounds of GAC and to accommodate approximately 30% bed expansion within the straight side of the vessel using Filtrasorb 400 GAC (the percent bed expansion will vary depending on the apparent density of the GAC selected for the specific application). The vessels are designed, constructed, and stamped in accordance with ASME Section VIII, Division 1 and registered with the National Board for a design pressure rating of 125 psig at 140°F. Each vessel will be provided with one (1) 20" diameter round manway located on the lower straight side portion of the vessel and one 14" x18" elliptical manway located on the bottom head. The vessel will be free standing utilizing four (4) structural steel support legs. The vessels will be provided with four (4) lift lugs located on the top head and one (1) tailing lug on the bottom head.

C. The structural aspects of the vessel will be sufficient to meet the International Building Code - IBC 2012 requirements of S_s =1.5, Site Class D, I=1.25. Calgon Carbon Corporation can submit detailed calculations on request illustrating the seismic characteristics of the proposed vessel.

D. Each vessel will be designed with an internal 30° cone bottom underdrain system that provides uniform distribution of the treated water using a minimum of one (1) septa nozzle for every nominal square foot of vessel cross section, facilitates GAC removal without the need to open the manway to manually hose out the remaining spent GAC, and allows replacement of the septa without the need to remove external piping. The septa will be designed to contain the GAC within the adsorber and be constructed of stainless steel.

E. Each vessel will be provided with the following stainless steel nozzles:

a. One (1) 6" nozzle on the upper sidewall of the vessel for GAC fill.
b. Two (2) nozzles for GAC discharge. One (1) 6" GAC discharge nozzle is located on the vessel side wall and one (1) 4" centered on the bottom head.
c. One (1) 8" influent nozzle located on the top head constructed of stainless steel and provided with an internal flange to support the inlet distributor.
d. One (1) 8" effluent nozzle located on the bottom head.
e. Three (3) 2" sample nozzles located on the side wall.
f. One (1) 2" cone vent nozzle located on the lower side wall.

F. All surfaces will be degreased prior to sandblasting. The adsorber internal surface that will be lined will be blasted to a white metal finish (SSPC-SP5) to provide a 3 to 4 mil anchor pattern. The exterior surfaces of the adsorber will be prepared by blasting per SSPC-SP6.

G. The interior surfaces of the vessel will be lined. The surfaces above the internal cone with a nominal lining thickness of 35 to 45 mil dry film (dft) and the surfaces under the internal cone bottom a nominal lining thickness of 10 to 12 20 to 25 mil dft. The lining material will be one of the following:
a. Carboline's Plasite 4110, vinyl ester lining

b. Blome International's TL-220S AR, vinyl ester lining
c. Carboline's Reactamine 760, aromatic polyurethane hybrid

H. The exterior surface of the adsorbers will be painted to a dry film thickness of 10 to 14 mil with a high solids epoxy (gray color) paint and finished with a polyurethane topcoat of 2 to 3 mil dft.

2.03 Process and Utility Piping

A. The process and utility piping on the adsorption vessel will include:
a. a pipe for influent water to the system
b. a pipe for backwash discharge water (to include a blind flange)
c. a pipe for treated water (effluent)
d. a pipe for backwash supply (to include a blind flange),
e. an adsorber vent and relief line located on the influent pipe,
f. sample piping,
g. GAC fill pipe,
h. GAC discharge pipes.

B. Piping shall accommodate one (2) train of two vessels each in series. The vessels in series shall be in a lead/lag configuration. Lead/lag operation allows either; a) flow from the influent flange to Adsorber A, to the pipe module, to Adsorber B, to the pipe module then to the effluent flange, or b) flow from the influent flange to Adsorber B, to the pipe module, to Adsorber A, to the pipe module then to the effluent flange. The change in flow pattern is accomplished with a change of valve positions. The purpose of lead/lag operation allows an adsorber to act as an on-line backup and/or provides for sufficient contact time to allow adsorption of the contaminants of concern.

C. Process piping (influent, effluent and backwash) will be 8" diameter, constructed of schedule 40 carbon steel, ASTM A53 Grade B materials with 125# ASTM A126 Class B cast iron flanged fittings.

D. Vent piping will be 3" diameter, constructed of schedule 40 carbon steel, ASTM A53 Grade B materials.

E. Carbon fill piping will be 4" diameter, constructed of schedule 40 carbon steel, ASTM A53 Grade B materials. The connection at the vessel side wall will be a 4"x 6" reducing elbow. The GAC fill connection will be supplied with an adjustable stainless-steel insert. There is a total of one (1) GAC fill line per vessel.

F. Carbon discharge piping will be 4" diameter, constructed of schedule 40 polypropylene lined carbon steel, ASTM 53 Grade B materials with ppl lined flanged fittings. The connection at the vessel side wall will be a 4"x 6" ppl lined fitting. There are a total of two (2) GAC discharge lines per vessel.

G. The vessel must be designed with an adjustable GAC removal system to allow for removal of the spent carbon in 20,000 lb increments.

H. The vessel will be provided with three (3) 2" side sample nozzles for use with in-bed water sample probes. Sample probes consist of a 12" stainless steel pipe with a stainless-steel slotted nozzle to collect a water sample from within the carbon bed. The sample probe will

be inserted through a 2” flanged nozzle (flanged nozzle to assure adequate coverage by the internal lining); and will be provided with a drop line and shutoff valve external to the adsorber and terminate at approximately 48” above grade.

I. Utility piping will be constructed of threaded schedule 80 carbon steel, ASTM 53 Grade B materials.

J. All piping surfaces will be prepared by blasting per SSPC-SP7.

K. The exterior surface of the piping will be painted to a dry film thickness of 5 to 7 mil with a high solids epoxy (gray color) paint material prior to assembly to ensure minimum oxidation at flanged connections.

L. The piping network will be provided with a structural steel support frame for support of the piping module.

2.04 Process and Utility Valves

A. The process and utility piping; excluding GAC fill and discharge piping will be equipped with butterfly valves for flow control. For each system/train, a total of ten (10) 8” diameter butterfly valves will be supplied to accommodate the process and backwash control functions. Two (2) valves are needed for backwash control, two (2) valves are needed for influent isolation, two (2) valves for effluent isolation, two (2) valves for staging of the vessels in lead/lag configuration, and two (2) valves for the backwash supply function. Butterfly valves in the valve manifold shall be Bray 30 series or approved equal, with manual actuators, as specified in Section 026450.

B. The influent, effluent, and backwash control valves will be a cast iron flanged type body butterfly valve with aluminum-bronze disc, BUNA-N seats, and stainless-steel shaft to mate to 150-pound ANSI flanges. The valves are rated for 200 psig in closed position at 180°F and meet or exceed section 5.0 of AWWA specification C-504-87.

C. The carbon fill and discharge valves are 4” diameter full port ball valves, 316 stainless steel construction with TFE seats and seals. For each system/train a total of four (4) valves are supplied, two (2) for carbon fill and two (2) for carbon discharge.

D. Utility valves for the compressed air supply will be bronze or brass or barstock brass body regular port ball valves.

2.05 Instrumentation

A. Instrumentation will be accessible from grade.

B. Pressure relief will be provided by a 3” rupture disk constructed of impervious graphite and designed to relieve pressure at the design pressure of the vessel and at the maximum flow to the vessel. The rupture disk will be mounted off the vessel vent line and vent to atmosphere. One (1) will be provided for the vessel.

C. Each vessel will be provided with an indicating differential pressure switch, 4” diameter dial, scaled for 20-0-20psi. The switch is rated at 1.0 amp @ 115 volts AC for remote indication. A total of Two (2) will be provided for each system.

D. The process piping will be equipped with pressure gauges to indicate the pressure entering and exiting each adsorber and to provide information on pressure drop across each adsorber and the system. The pressure gauges will have 4 ½" face diameter with a stainless-steel bourdon tube in a phenolic case housing (1 to 160 psig range). A total of three (3) will be provided for each system.

E. The process piping will be equipped with sample taps to enable sampling of the water entering and exiting each adsorber. A total of three (3) will be provided for the system.

2.06 Miscellaneous

A. Each vessel will be provided with an inlet distribution system connected to the inlet nozzle consisting of multiple radial arms. Each arm is drilled along its length to facilitate even distribution of water during normal operation and collection of backwash water. The assembly will be constructed using 304 stainless steel.

B. The carbon fill and discharge will be fitted with hose connections, such that carbon transfer to and from the adsorbers can be facilitated using carbon transfer hoses. These connectors will be 4" Quick Disconnect Adaptors constructed of aluminum as manufactured by Dover Corp. as Kamlock connectors or equal.

C. Two (2) flush connections will be provided on each GAC fill line, one upstream (air) and one downstream of the valve (water). One (1) flush connection will be provided on each GAC discharge line, downstream of the valve (water). The connections will be welded into the steel or stainless-steel pipe or screwed into solid propylene "spacers" for the lined pipe. Flush connections will consist of a short section of ¾" pipe, a ¾" full port ball valve and a ¾" quick disconnect adaptor to match with appropriate air or water hose fittings.

D. The vessels shall include strainers. Each vessel will be provided with one (1) 8" stainless steel effluent strainer basket mounted in the effluent line from the vessel. The basket strainer shall be constructed of 316 stainless 14 gage plate with 1/8" diameter holes drilled on 3/16" centers, covered with 40 mesh 316 stainless steel screen and topped by a 4 mesh 316 stainless steel support screen (0.063" wire diameter). A total of two (2) will be provided for the system.

E. The influent and effluent pipe for each vessel will be provided with a molded neoprene reinforced rubber expansion joint which allows 4-way movement and 30° angular misalignment. A total of four (4) will be provided for the system.

F. Each vessel will be provided with an inlet distributor constructed of 316 stainless steel. The distributor will connect to the inlet nozzle and be fitted with multiple arms. Each arm is drilled along its length to facilitate even distribution of water during normal operation and collection of backwash water. A total of two (2) distributors will be provided for the system.

G. In-Bed Sample Taps: Each adsorber will be provided with three (3) 2" side sample nozzles for use with in-bed water sample probes. Sample probes consist of a 12" stainless steel pipe with a stainless-steel slotted septum to collect a water sample from within the carbon bed. The sample probe will be inserted through a 2" flanged nozzle and will be provided with stainless steel tubing drop line and stainless-steel shutoff valve

external to the adsorber. A total of six (6) in-bed sample taps will be provided for the system.

H. Air/Vacuum Release Valve – Option Adder: Each adsorber can be provided with one (1) 1" combination air/vacuum release valve mounted at the top of the influent pipe. Two (2) 1" ball valves will be provided to isolate the air release valve, one ball valve positioned between the influent pipe and the air release valve and the second mounted at the bottom of the air release piping (at ground level). A total of two (2) will be provided for the system.

I. Each system will be provided with one Carbon Acceptance Canister. This will allow for testing of the carbon to determine its suitability for reactivation or disposal

2.07 Granular Activated Carbon – The GAC shall be Filtrasorb 400AR+ Acid Rinsed GAC, or approved equal, per the specification provided below:

FILTRASORB 400AR+	Value	Test Method
Iodine Number (mg/g), min.	950	ASTM D4607
Moisture, weight %, max.	2	ASTM D2867
Effective size, mm	0.55 – 0.75	ASTM D2862
Uniformity Coefficient, max.	1.9	ASTM D2862
Abrasion No., min.	75	AWWA B604
Screen Size (US Sieve), weight %		
* Larger than No. 12, max.	5.0	ASTM D2862
* Smaller than No. 40, max.	4.0	ASTM D2862
Typical Property	Value	
Apparent Density, g/cc, min.	0.54	ASTM D2854
Ash	10%	ASTM D2866
Water Extractables	<4%	AWWA B604
Non-Wettable	<1%	AWWA B604

a. The Certificate of Analysis shall certify that the GAC sample shipped to the site is 100% virgin carbon and in full compliance with the specifications stated herein. Failure to comply shall be considered non–responsive and the GAC shall be rejected.

b. The successful bidder must supply a signed Affidavit of Compliance stating that the GAC they are supplying is:
    a. 100% virgin, with no reactivated carbon content whatsoever, and
    b. 100% bituminous coal-based reagglomerated material

2.08 Equipment supplier shall provide 20,000# Filtrasorb 400AR+ GAC, or approved equal, per Model 10 vessel delivered via bulk truck and installed via water slurry.

2.09 Alternate GAC products will require laboratory testing to be performed to demonstrate performance and to be considered a qualified equal to Filtrasorb 400AR+.

PART 3 – EXECUTION

3.01 Supplier Services

A. A manufacturer's trained specialists, experienced in the installation of the adsorption systems, and with at least five (5) years of field experience will be present at the job site and to provide the following services:
- Inspection of the reinstalled equipment
- Supervision of carbon loading
- Start-up assistance
- Troubleshooting
- Operator training

B. The supplier shall retain design and fabrication documentation for a minimum period of seven (7) years following completion of the project.

3.02 Site Materials and Services

The contractor shall be responsible for providing materials, installation, and site services, including:

1. Process valves
2. Instrumentation
3. Site preparation, foundation design and foundation installation including vessel anchoring system
4. Receipt, off-loading (and storage) of adsorption system equipment
5. Installation of adsorption system equipment
6. Connection of the dP switch to an alarm system
7. Provision of a means to keep the vessel flooded in all operating modes[1]
8. Any hydrostatic test of the installed (assembled) system at the site
9. System connection to existing infrastructure
10. System disinfection prior to initial fill of carbon
11. Utilities for bulk loading of GAC (compressed air, clean water source, backwash water disposal)
12. Operation of the system during carbon fill operation
13. Mechanical startup of the system

The contractor shall take all the necessary precautions not to damage the equipment during the relocation from the concrete pads to the inside of the proposed building.

PART 4 – QUANTITY AND PAYMENT

4.01 GAC Contactor System Equipment

A. Owner will provide coordination for GAC Contactor System Equipment. No payment shall be made to the Contractor for this equipment.

4.02 GAC Contactor System Installation

A. Payment for installation of all materials associated with the GAC Systems in accordance with the drawings or as directed by the Engineer shall be on a lump sum basis for the item "GRANULAR ACTIVATED CARBON TREATMENT SYSTEM INSTALLATION, COMPLETE" as indicated in the Bid Form. Include all labor and equipment costs for installation of vessels, GAC media, valve manifolds, piping, and appurtenances delivered to the site as part of the GAC systems.

4.03 Electrical and Controls Work

A. Payment for electrical and controls costs associated with the GAC System Equipment for electrical connections, and communication wiring, required for a complete project in accordance with the drawings or as directed by the Engineer shall be made on a lump sum basis for the item "INSTRUMENTATION AND CONTROL SYSTEMS, COMPLETE" as indicated in the Bid Form.

4.04 SCADA

A. Payment for electrical and controls costs associated with the GAC System Equipment for connection to the existing control system required for a complete project in accordance with the drawings or as directed by the Engineer shall be made on a lump sum basis for the item "ALLOWANCE FOR SCADA INTEGRATION, COMPLETE" as indicated in the Bid Form.

END OF SECTION 113050

SECTION 466616 - CLOSED-VESSEL LOW-PRESSURE/HIGH-INTENSITY ULTRAVIOLET TREATMENT EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Closed-vessel, low-pressure, high-intensity ultraviolet treatment equipment. The Contractor shall furnish and install ultraviolet disinfection equipment, and all appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Two (2) Low Pressure UV reactors to be provided each capable of treating a flow of 1,000 gallons per minute (1.44 MGD).

B. Related Requirements:

1. Section 260583 "Wiring Connections" for execution and product requirements for connecting equipment specified by this Section.
2. Section 460553 "Identification for Water and Wastewater Equipment" for nameplates for equipment specified in this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with Work of other Sections.

B. Maintain flow of water and its disinfection until proposed system is tested, approved, and fully operational.

1.3 SUBMITTALS

A. Submit for review, engineering drawings showing the following:
1. Complete description in sufficient detail to permit comparison with the specifications.
2. Dimensions and installation requirements.
3. Descriptive information including catalogue cuts and manufacturer’s specifications for all major components.
4. Electrical schematics and layouts.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of installed UV treatment equipment and accessories.

1.5 QUALITY ASSURANCE

1.6 A. The manufacturer shall validate to New Jersey N.J.A.C. 7:10 Safe Drinking Water Act Rules pertaining to UV disinfection.

1.7 DESIGN REQUIREMENTS

A. Effluent Criteria
1. Average Wet Weather Flow: 2.88 MGD
2. Peak Design Flow: NA
3. Acceptable Turbidity Range: 0-5 NTU
4. Annual Effluent Temperature Range: 34° F to 104° F
5. UVT range : 70% to 100% at 254 nm adjusted to a 1cm path length. Minimum UV Dose: 100 mJ/cm2.
6. 1,4 Di-Oxane: less than 0.3 parts per billion (ppb).

B. Performance Criteria
1. The ultraviolet disinfection system shall produce an effluent with 1,4 Di-Oxane concentrations less than 0.3 ppb. Performance shall be verified through performance testing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 WARRANTY

A. Performance Warrantee

1. The UV system furnished under this section shall meet the performance criteria specified in this section. Performance testing will be conducted as specified in this section to determine that the supplied equipment meets the performance criteria.

2. The manufacturer shall provide a performance bond in the amount of the cost of the equipment. Performance bond will be released upon demonstration that equipment meets the performance criteria via performance testing protocol specified in this section.

B. Equipment Warrantee

1. The equipment furnished under this section shall be free of defects in materials and workmanship, including damages that may be incurred during shipping, storage, and installation for a period of two (2) years from date of equipment acceptance.

2. The UV lamps to be warranted for a minimum of 15,000 hours, on a prorated basis.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. The Municipality of Merchantville-Pennsauken Department of Public Works standards.
3. Merchantville-Pennsauken Water Commission standards.

B. The objective of the performance test is to demonstrate that the equipment, as installed, achieves the design limits, as indicated in the Performance criteria. The duration of the test shall be ten (10) business days. Sampling may be done any time over a three (3) week period.

C. The Owner will perform initial performance testing outlined in this paragraph. Owner will also pay for costs associated with initial performance testing. If additional testing is required to determine whether equipment meets the performance requirements, the manufacturer shall perform and pay for additional tests.

D. Performance Test Procedure

E. One (1) set of samples shall be collected per day for ten (10) business days. A set of samples shall consist of a sample collected prior to treatment by the UV system, and a sample collected after treatment by the UV system. Ten (10) sets of samples shall be taken in a three-week period.

F. Sampling and Testing Procedures

1. Sample collection, preservation, and analysis shall be in accordance with section 9010, 9060 and 9060 B in Standard Methods for The Examination of Water and Wastewater, 19th edition.
2. Samples are to be taken as grab samples, samples taken at a specific time and location, as opposed to composite or blended samples taken over a given time period.

2.2 CLOSED-VESSEL, LOW-PRESSURE, HIGH-INTENSITY ULTRAVIOLET TREATMENT EQUIPMENT

A. Manufacturers:

1. Trojan Technologies (Series UV Flex) or approved equal.

2. Description: Closed-vessel, horizontally orientated UV disinfection system, consisting of following:

a. UV lamp module with support rack and bracket.
b. Instrumentation, controls, and power distribution.
c. UV monitoring system.
d. Elapsed time meter.
e. Lamp cleaning system.

3. Provide a UV disinfection system complete with UV modules, control panel, and detection systems, as herein specified.

4. The system shall be designed to allow for complete system shut down or by-pass.

5. The system shall be able to continue providing disinfection while replacing UV lamps, quartz sleeves and ballasts, and while cleaning the sleeves.

6. System shall be configured as shown in the plans fit channel and specified in this section. Any modifications required by manufacturer to furnish and install this equipment shall be considered coincidental to the contract.

7. System design shall be based on the following:

a. Ultraviolet transmittance at 253.7 nm: 65% at a minimum UV dose of 100 mJ/cm2.
b. Performance shall be based on providing full redundancy at average wet weather flow.

8. Any deviations from system design basis proposed by supplier must be based on actual performance data provided by supplier.

9. The system shall be hydraulically controlled with manufacturer supplied finger weir.

B. Lamps:

1. Type:

a. Mercury vapor.
b. Design: Hot cathode, instant start.
c. High intensity, low pressure amalgam.
d. Operated by electronic or magnetic ballasts at multiple power settings.

2. Filament: Clamped design to withstand shock and vibration.

3. Module:

a. Description: Lamps placed in individual fused-quartz sleeves, and sealed and supported in NEMA 6P stainless-steel frame.
b. Wiring: Completely enclosed and protected from water.
c. Base: Metal and ceramic. Resistant to UV and ozone.
d. Replacement: Capability of replacing lamp without disassembling or removing sleeve.
e. Furnish mechanical lifting device for individual lamp modules weighing over 55 lb.

4. Sleeves:

a. Description: Single piece clear fuse quartz tubing. Close one end of each sleeve and seal opposite other end with lamp end seal and O-ring.
b. Material: Clear Fused quartz
c. Seal: Stainless-steel nut and O-ring seal.
d. Configuration: Prevent lamp sleeve from touching steel components.

5. Ballasts:

a. Comply with ANSI C82.4.
b. Design: Modular, for quick disconnect and replacement.
c. Conducted and Radiated Emission: Comply with 47 CFR 15.
d. Power Output: 1 percent incremental steps from 30 to 100 percent of rated lamp power.

C. Performance and Design Criteria:

1. Flow Rate:
   a. Peak: 2.88 MGD.
2. Acceptable Turbidity Range: 0-5 NTU
3. Pressure Drop at Peak Flow: 0.1 in H_2O
4. Water Temperature Range: 34 to 104 degrees F.
5. System Pressure: 60 psi (standard), 90psi and 120 psi (optional)
6. UVT range : 70% to 100% at 254 nm adjusted to a 1cm path length.1,4 Di-Oxane: less than 0.3 parts per billion (ppb)
7. Lamps:
   a. Number: 32 operating per chamber AND capable of future expansion to 64 lamps per chamber
   b. Type: Low pressure, high intensity.
   c. UV Transmittance at 254 nm: 96 percent (minimum).
   d. Minimum UV Output per Lamp: 500 W.
   e. Minimum Arc Length: 40 inches.

8. Maximum Ozone Production: Zero.

D. Materials:

1. Metal Components in Contact with Water: Type 304 stainless steel.
2. Components Exposed to UV Light: Quartz.

E. Operation:

1. Electrical Characteristics:
   a. Each bank shall be powered from a Power Distribution Center. Service entrance for power feed termination to be provided.
   b. Maximum total power consumption rating shall be no greater than 42 kW.
   c. Electrical supply to each Power Distribution Center shall be 480 volts, 3 phase, 5 wire.
   d. Electrical supply to the mechanical system center of each reactor shall be 120 V, 1 phase, 2 wire.
   e. Electrical supply to the system control center shall be 120 V, 1 Phase, 2 wire plus gnd..

f. Signal wiring interfacing the UV system and the System Control Center (SCC), shall be as shown on the Engineering Drawings.

2. Control Panel:
   a. Enclosure material shall be type 304 Stainless steel.
   b. Each module sub-system shall be wired from the main power distribution blocks into an Earth Leakage Protection Device (ELPD).
   c. All internal components shall be sealed from the environment.
   d. All CPP's to be UL approved with a minimum rating of NEMA 12.
   e. All local fused disconnects or breakers to be supplied by others.

3. Controls:

   a. Description: Automatic flow-and water-quality-paced Allen-Bradley PLC which continuously monitors and controls the UV system's functions. The control system energizes and de-energizes lamps to maintain required UV dosage, and adjusts UV intensity in proportion to water flow rate.
   b. OIS: The operator interface shall be menu driven with automatic fault messages when alarm conditions are annunciated. Complete control and monitoring of the entire system is accomplished through this interface.
   c. Signals: 4 to 20 mA dc.
   d. Furnish programming to perform operations.
   e. Lamp Status Indicators: ON-OFF.

4. Lamp Monitoring System:

   a. Indicate location and operating status of each lamp.

   b. Annunciate remote alarm upon lamp failure.

   c. Alarm history register: gives a record of the 20 most recent alarm conditions, recorded by alarm type, date, and time of accurance.

   d. Alarms shall identify the affected lamps by an address system. The address shall specify the bank, module, and lamps.
   e.

5. UV Intensity Detection System:

   a. Description: Sense and display intensity in each bank of lamp modules between 254.5 and 255.0 nm.
   b. Furnish one UV intensity meter for each bank of lamp modules.
   c. Indicates safe intensity, low intensity, and unsafe intensity by means of color codes on meter face.
   d. Each back shall be capable of being placed in either On, Off or Remote mode.
   e. The UV module banks shall be cycled for equal wear and timed off to minimize bank cycling.

6. Elapsed Time Meter:

   a. Description: One nonresettable elapsed time meter for each bank of lamp modules.

b. Operation: Zero to 99,999 hours.
c. Elapsed time of each bank shall be recorded and displayed on the display screen when prompted.

7. Switches: Furnish one HAND-OFF-AUTO switch for each UV bank.
8. Alarms shall be provided to indicate an extreme alarm condition in which the disinfection performance may be jeopardized. The alarms shall include:
   a. LOW UV INTENSITY : shall be preset at the factory for 25% of the intensity after 100 hours burn-in of the lamps. The alarm set point shall be field adjustable. Individual LAMP FAILURE: failed lamps shall be indicated by specific address (i.e. bank # / module # / lamp #).
   b. Two or more adjacent LAMPS FAILURE.
   c. Multiple LAMPS FAILURE.
   d. MODULE FAILURE.
   e. Low UV Dose: shall occur when the design dose is not being delivered.

9. Disconnect Switch: Factory mounted in control panel.

2.3 ACCESSORIES

A. UV Transmittance Analyzer: the UV system shall be equipped with an on-line transmittance measurement device, specifically designed for continuous monitoring of the effluent UV transmittance.

1. Description:

   a. Analyzer, sensor, and sampler, each with a separate NEMA 250 Type 4X enclosure.
   b. Continuously monitor percent UV transmittance of water.

2. Range: Zero to 100 percent transmittance.
3. Accuracy: Plus and minus 1 percent of full scale.
4. Operating Temperature Range: 20 to 120 degrees F.
5. Alarms: HIGH. LOW, and OFF.
6. Display: LCD, with a 60 minute graph.
7. Manufacturer: Trojan
8. Model: Optiview.

B. Dose-Pacing:
1. A dose-pacing system shall be supplied to turn the UV banks on and off in relationship to a 4-20 mA DC signal from an effluent flow monitor as well as a signal from a UVT monitor, which shall be supplied by the UV manufacturer, and individual UV intensity sensors.

2. The system to be dose-paced such that as the flow changes, the design dose delivered is optimized while conserving power.

3. The dose-pacing system shall allow the operator to vary the design dose setting. Logic and time delays shall be provided to regulate the UV bank ON/OFF cycle.

C. Cleaning System:

1. Description:

a. Automatic mechanical/chemical cleaning system, capable of cleaning lamps during disinfection and without removing lamps from unit.
b. Automatically wipe lamp sleeve surface while dowsing lamp sleeve surface with acidic solution.
c. The cleaning system shall be fully operational without requiring either lamps or modules be placed out of service.
d. The system shall be provided with the required cleaning reagents and solutions necessary for initial equipment testing, for equipment start-up, and for one (1) year of operation.

2. Cleaning Cycle: Field adjustable, from once each hour to once each month.
3. Manual Operation: Furnish operator interface.

D. Hydrogen Peroxide Tank and Dosing System

1. Furnish and install a 3,000-gallon nominal capacity dual contained HDLPE primary tank with UV inhibitor and dosing system. The tank shall be contained in a 4,000-gallon secondary tank. Manufacturer: Peabody (supplied by Trojan)

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Owner Inspection:

1. Make completed clarifier equipment available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven (7) days before inspection is allowed.

C. Owner Witnessing:

1. Allow witnessing of factory inspections and test at manufacturer's test facility.
2. Notify Owner at least seven (7) days before inspections and tests are scheduled.

D. Certificate of Compliance: If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that facilities are ready to receive floating mechanical mixers.

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

3.2 INSTALLATION OF CLOSED-VESSEL, LOW-PRESSURE, HIGH-INTENSITY ULTRAVIOLET TREATMENT EQUIPMENT

A. According to manufacturer instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection and Functional Testing:

1. Operate UV system for minimum seven consecutive days with plant water.
2. Test and Inspect:

    a. Proper installation and alignment of UV support racks and frames.
    b. Watertightness.
    c. Electrical wiring and connections.
    d. Instrumentation, alarms, and indicators.
    e. ON-OFF and HAND-OFF-AUTO switches and ground fault circuit interrupters.
    f. Lamp removal system.
    g. Lamp cleaning system.

B. Performance Testing:

1. After installed UV equipment has been inspected and functional test has been completed, begin performance testing.
2. Collect samples at or near peak flow rate.
3. Analyze samples for following parameters:

    a. Fecal coliform, MPN per 100 mL, immediately upstream of UV treatment equipment.
    b. Fecal coliform, MPN per 100 mL, immediately downstream of UV treatment equipment.
    c. TSS, immediately upstream of UV treatment equipment.
    d. Percent UV transmittance (UVT) at 254 nm, immediately upstream of UV treatment equipment.

4. Test for 2 continuous days, and collect and analyze samples three times in each 24-hour period.
5. If sample results do not meet specified performance, retest for minimum two additional consecutive days or until acceptable bacteriological results have been obtained.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

B. Manufacturer Services:

1. Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**Insert**> days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in maintenance of equipment.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

PART 4 – QUANTITY AND PAYMENT

4.1 Advanced Oxidation Process:

Payment for all materials and installation associated with the UV system in accordance with the drawings or as directed by the Engineer shall be on a lump sum basis for the item "ADVANCED OXIDATION PROCESS INCLUDING HYDROGEN PEROXIDE FEED SYSTEM AND UV DISINFECTION SYSTEM, COMPLETE" as indicated in the Bid Form. Include all material supplied by the UV vendor including costs for the vessels, valve manifolds, all labor and equipment costs for installation of vessels, valve manifolds, piping, Programmable Logic Controller, piping, and appurtenances delivered to the site as part of the UV system.

4.2 Electrical and Controls Work:

Payment for electrical and controls costs associated with the UV System Equipment for electrical connections, and communication wiring required for a complete project in accordance with the drawings or as directed by the Engineer shall be made on a lump sum basis for the item "INSTRUMENTATION AND CONTROL SYSTEMS" as indicated in the Bid Form.

4.3 SCADA:

Payment for electrical and controls costs associated with the UV System Equipment for connection to the existing control system required for a complete project in accordance with the drawings or as directed by the Engineer shall be made on a lump sum basis for the item "ALLOWANCE FOR SCADA INTEGRATION, COMPLETE" as indicated in the Bid Form.

END OF SECTION 466616

APPENDIX A:

GEOTHECNICAL REPORT

REMINGTON & VERNICK ENGINEERS

RVE HQ:
2059 Springdale Road
Cherry Hill, NJ 08003
O: (856) 795-9595
F: (856) 795-1882

December 11, 2023

Mr. Jack Killion, Chief Operating Officer
Merchantville-Pennsauken Water Commission
6751 Westfield Avenue
Pennsauken, NJ 08110

Re: Letter Report on Geotechnical Investigation
Proposed Browning Road Water Treatment Plant Improvements
4430 Frosthoffer Avenue
Pennsauken, Camden County, New Jersey
RVE Ref. No. 0424-M-081

Dear Mr. Killion:

Remington & Vernick Engineers (RVE) has performed a geotechnical investigation for the referenced project. The purpose of the investigation was to determine subsurface conditions at the site of the proposed new water treatment building and to make recommendations, from a soils engineering viewpoint, for the design and construction of the new building's foundation system. All of the information obtained, together with our interpretation of the findings, is presented herein.

Sincerely,
REMINGTON & VERNICK ENGINEERS

K. Charles Westen

K. Charles Westen, P.E.
NJ PE License No. 47013

Attachments

Cc: Dennis Yoder, PE (RVE)
Kenneth Ressler, PE (RVE)
Jacqueline Trovato, PE (RVE)

Introduction

Remington & Vernick Engineers (RVE) has been retained by Merchantville-Pennsauken Water Commission (MPWC) to carry out a geotechnical investigation for the proposed improvements to existing Browning Road Water Treatment Facility. The proposed improvements include the construction of a new building containing mechanical equipment and new granulated activated carbon (GAC) tanks. The location of the proposed construction is located within the existing MPWC Browning Road Facility at 4430 Frosthoffer Avenue, Pennsauken, NJ. The purpose of the investigation was to determine the subsurface conditions at the proposed new water treatment building site and to provide recommendations for the design and construction of the proposed new building. All of the information obtained, together with our interpretation of the findings, is presented herein.

Fieldwork & Subsurface Conditions

The field work for the test boring investigation was conducted on October 26, 2023, and consisted of three geotechnical test borings, drilled to depths ranging between 23.33 to 52 feet below existing grade. The test borings, designated B-1 through B-3, were performed by Boring Brothers, Inc. utilizing a track mounted drill rig and the mud rotary drilling method at locations selected in the field by RVE. All drilling and soil sampling operations were supervised by RVE and the field logging of the soil samples was performed by a representative of RVE.

Soil samples were recovered via a two-inch O.D. split-spoon sampler; driven by a hydraulically activated 140-pound hammer, free falling 30 inches (ASTM D 1586). The number of hammer blows required to advance the 24-inch spoon in 6-inch increments (four increments in all) were recorded. The number of blows required to penetrate the middle two increments (6 to 18 inches) is known as the Standard Penetration Resistance (N). Soil samples were obtained continuously in the upper 12 ft and at 5 ft intervals thereafter. Recovered soil samples were visually classified in the field using the Burmister Soil Identification System and the Unified Soil Classification System. The results of the visual analyses were utilized to prepare the attached Soil Boring Logs. The locations of the test borings are shown on the attached boring location plan.

Beneath an approximately 3 to 6 inch layer of topsoil, granular and cohesive fill soils were encountered down to a depth of 2 to 4 feet below existing grade in all 3 borings. Underlaying the fill soils, cohesive and granular alluvial soils were encountered and extended to the termination depths of the borings. The cohesive alluvial soils were encountered in boring B-1 at a depth of 2 to 5 feet below existing grade and in boring B-3 at a depth of 2 to 4 feet below existing grade. Cohesive alluvial soils were not encountered in boring B-2. The cohesive alluvial soils can be described as brown and orangish brown clayey silt with some fine sand. Underlaying the cohesive stratum in borings B-1 and B-3 and underlaying the fill stratum in borings B-2, granular alluvial soils were encountered, and extended to the termination depth of all borings. The soils in this stratum can be described as orangish brown, brown, light brown and light gray coarse to fine sand with little to trace silt, little to no clay and little to no medium to

fine gravel. The relative consistency of the cohesive alluvial soils varies from soft to stiff with SPT N_{60}-values ranging from 3 to 11 blows per foot (bpf). The relative density of the granular alluvial deposits varies from compact to very dense with SPT N_{60} and $N1_{60}$ values ranging from 19 to over 50 bpf.

Groundwater was encountered at approximately 12 feet below existing grade in both borings at the time of drilling. Groundwater levels generally can fluctuate due to changes in precipitation, infiltration, surface run-off and other hydrogeological factors. Therefore, the groundwater level present at the time of construction may vary from that observed at the time of the drilling operations. Shallow perched groundwater may be encountered during construction, especially if work commences after a wet weather period.

Recommendations

General

Based on the results of our field investigation we have evaluated the existing subsurface soils to determine their engineering properties. On the basis of this evaluation, we have made the following recommendations for the proposed structure, from a geotechnical perspective. It is our understanding that the proposed improvements include a new building with six GAC tanks and various mechanical equipment. The building will a single story masonry bearing wall and steel framed structure, having a building footprint of approximately 4,040 square feet (sf).

Site Preparation Procedures & Earthwork Operations

The proposed construction area is defined as the area within the proposed addition limits, and a 5-foot and 3-foot wide zone outside the building and pavements, respectively.

1. Clear and strip from the construction area, any existing asphalt pavement or any other deleterious material. Any existing utilities found within the proposed building limits will have to be rerouted outside the building footprint. Any debris, old foundations or abandoned pipes encountered during excavation, will have to be removed completely from the area under the proposed building to a minimum depth of 2 feet below the bottom slab elevation and completely from the area of the foundations. If any pipes are to be left in place, they must be completely filled with cement grout.

2. Excavate the site, where necessary, to proposed subgrade elevations. Over-excavate any unsuitable material or soils encountered below this elevation in the zone of influence of the foundations. The zone of influence is the volume of soil within lines drawn downward and outward, from the lower edges of a foundation, at a slope of 1.5H:1V. Unsuitable material includes all deleterious material, bricks, debris, rubble, or any other undesirable material designated by the on-site representative of the Geotechnical Engineer. Undesirable natural soils include all soft and loose soils

encountered under the bottom of the foundation elevation. Replace the over-excavated material with controlled structural fill as defined herein.

3. After excavation to proposed subgrade and prior to the placement of any fill, the resulting subgrade should be rigorously proof rolled and compacted with a 10-ton heavy-duty vibratory roller. This should be done during a dry and favorable weather period, and under the technical supervision of a representative of the Geotechnical Engineer. A minimum of 8 overlapping passes is recommended to densify the upper 2 to 4 feet of on-site soils. The vibratory mode should be turned off within 20 feet of existing structures. No heavy equipment should be operated within 5 feet of existing structures. Compaction in the vicinity of existing structures should be accomplished using a mechanical compactor such as a walk behind roller or similar device as approved by the Geotechnical Engineer.

4. Undercut any zones of instability disclosed by the proof rolling, as determined by the on-site representative of the Geotechnical Engineer and replace the undercut material with controlled structural fill as defined herein. As required, raise the ground surface to the proposed subgrade elevation with controlled structural fill. All material used as controlled structural fill material in the building area should comply with the requirements given herein and approved by the on-site representative of the Geotechnical Engineer.

5. All load-bearing fill should be controlled structural fill placed in loose horizontal lifts with a maximum thickness of 8 inches. Controlled structural fill should consist of inorganic, readily compactable, predominantly well-graded granular soils with no more than 12% fines (material passing the No. 200 sieve), and a maximum particle size of 3 inches. The moisture content of the fill materials should be controlled to within 2% of the optimum moisture content, as determined by ASTM D 1557, by wetting, aeration or blending, as necessary. It is recommended that controlled fill within the construction area be compacted to at least 98% and 95% of the maximum dry density, as determined by the Modified Proctor Test (ASTM D 1557), below and above the footing subgrade elevations, respectively. In addition, it is recommended that all fills be stable without significant movement under construction traffic, as judged by the on-site representative of the Geotechnical Engineer. Quality control testing of in-place fill densities should be conducted throughout the entire earthwork operation.

6. Permanent slopes should not be steeper than 2H:1V and provision should be made to protect the surface against erosion by covering the surface with riprap or a suitable vegetative cover.

Excavation

On the basis of the information provided to us concerning the project, we expect relatively shallow excavations for foundation construction. Deeper excavations may be required for the placement of underground utilities.

Open excavations are feasible provided there is enough room so that the stability of the existing underground utilities and adjacent structures are not affected. The existing utilities and structures may be considered not affected by the open cut excavation if a line projected downward from the bottom of the existing utility or structure foundation at a 1.5H:1V does not intersect the excavation slope. Any section of the existing utilities and structures affected by the excavation should be supported by temporary sheeting and shoring. The side slopes of the open cut should not be steeper than 2H:1V.

If temporary shoring is utilized, the soil parameters presented in the table below are suggested for the design of the shoring. All excavations should be in compliance with "Excavating and Trenching Operations," manual (latest revision), issued by the US Department of Labor, OSHA 2226, and local requirements.

Temporary Shoring Design Parameters

Unit Weight of Soil (pcf)	120
Angle of Internal Friction (ϕ)	30°
Coefficient of Active Earth Pressure (K_a)	0.33
Coefficient of Earth Pressure At-rest (K_o)	0.50
Coefficient of Passive Earth Pressure (K_p)	3.0*

* A suitable factor of safety should be applied to K_p

The lateral load information presented in this report should be used only as a guideline by the contractor, and it should be a requirement for the excavation contractor to prepare a proposed sheeting design certified by a licensed professional engineer prior to construction. The excavation contractor should be responsible for the design, installation, and maintenance of all sheeting and shoring.

Regardless of the excavation option chosen, excavated soils should not be stockpiled adjacent to the sides of the excavations to avoid the imposition of additional loads, unless these loads are considered in the design of the temporary shoring or excavation side slopes. Additionally, the effect of excavation machinery should be included in the stability of the open cut slopes, as well as any temporary shoring design.

Excavated granular soils approved by the Geotechnical Engineer may be stockpiled on-site for use as a component of the backfill material. The moisture content will have to be kept as close as possible to the optimum moisture content of this material if it is to be placed successfully as controlled fill.

Backfill

The clean granular portions of the excavated soils can be reused for backfill after approval by the Geotechnical Engineer. Soils with organic or other deleterious materials, soft clays, clayey silts or silts and materials having particle sizes greater than 3 inches shall be discarded. The moisture content of the backfill soil must be within ±2% of the optimum value for proper compaction. Therefore, some adjustment of the moisture content may be necessary prior to use as backfill material. If imported fill materials are required to complete backfilling of the excavations, they should consist of uncontaminated, relatively well-graded granular soils as defined in Item 5 of the Site Preparation & Earthwork Operations portion of this report.

Backfilling against the foundations and for utility trenches, or other structural uses, should be accomplished using controlled structural fill, as defined in this report, compacted to 95% of the maximum dry density as determined by the Modified Proctor Test, ASTM D 1557. Compaction of the backfill within 5 feet of any existing structures should be carried out with relatively light equipment such as a jumping jack, a walk behind roller, or similar device as approved by the on-site representative of the Geotechnical Engineer. The backfill should be placed in 8-inch lifts and compacted to at least 95% and 90% of maximum dry density, as determined by the ASTM D-1557 test procedure, in structural areas and in paved or landscaped areas respectively.

Dewatering

The results obtained at the time of the drilling operation indicate that groundwater was encountered at a depth of 12 feet below existing grade. Therefore, continuous dewatering operations should not be required on this site for excavations shallower than 12 feet below existing grade. Dewatering of perched water, run-off water and any water encountered during construction can be performed using sump pumps.

If groundwater encountered in excavations deeper than 12 feet cannot be controlled by sump pumps, more elaborate dewatering methods such as deep wells or well points may be required. Dewatering with more elaborate dewatering methods will require a dewatering specification. Dewatering specifications should be of the performance type requiring that the contractor maintains the groundwater level at least 2 feet below the prevailing bottom of the excavation. The dewatering should be continuous during construction operations and until backfill has been placed and compacted to at least 2 feet above natural groundwater level.

Foundations

After site preparation operations have been satisfactorily completed, as recommended herein, the densified on-site natural soils and/or structural fill may be utilized to support the proposed structure using a shallow foundation system. Continuous wall footings and isolated column

footings may be used with the footing bottoms founded at a depth of 4 feet below existing grade. As an alternative to founding the footing bottoms at 4 feet below existing grade, foundation bottoms may be founded at a depth of 3 feet below existing grade provided that the cohesive soils encountered between depths of 3 to 4 feet below existing grade are excavated and replaced with dense graded aggregate (DGA) or the same class of concrete used for the footings. For design purposes a maximum net allowable bearing pressure of 3,000 pounds per square foot (psf) can be used. With the use of the recommended allowable bearing capacity, a satisfactory factor of safety will be provided against a shear failure and total and differential settlement will be within tolerable limits.

Wall and column footing widths should not be less than 2 and 3 feet, respectively. Exterior footings should be founded at a minimum depth of 3 feet beneath the exterior finished grades for frost protection. Interior footings in heated areas of the building can be founded at any convenient depth provided that the bottom of the floor slab and top of the concrete footings are separated by a minimum 6-inch thick layer of clean structural fill or granular base material. It should be pointed out that in no case should a line drawn at a 1.5H:1V slope from the nearest edges of the proposed foundation bottom elevation intersect with any existing foundations, and vise versa. If any adjacent foundations are above the proposed new footing founding level, and the 1.5H:1V slope intersects the new foundations, the existing foundations must be underpinned to prevent undermining the existing foundations or slabs.

The footing subgrades should be thoroughly compacted prior to the placement of the concrete utilizing a mechanical compactor such as a jumping jack, walk-behind roller, or similar device as approved by the on-site representative of the Geotechnical Engineer.

Prior to the placement of concrete, the foundation subgrade must be inspected by a qualified representative of the Geotechnical Engineer in order to confirm the soil bearing capacity. The contractor should exercise extreme caution not to disturb the subgrade soils. Should the subgrade be disturbed, the loosened soil should be compacted in-place or excavated down to firm soil. Any water which accumulates in the excavation bottom should be removed promptly.

Floor Slabs

Proposed reinforced concrete floor slabs can be uniformly supported on the densified natural soil or controlled structural fill after site preparation procedures have been successfully completed as discussed herein. The slabs should be structurally independent of walls and footings. Large floor areas should be provided with joints at frequent intervals as determined by the structural engineer. A minimum of 4 inches of ¾-inch clean crushed stone or a 12-inch thick layer (minimum) of well-graded sand and gravel with not more than 5% non-plastic fines is recommended below the slab to assure uniform bearing conditions and to act as a capillary break. A vapor barrier should be placed between the slab and base course, as directed by the Architect, to minimize moisture migration to the surface. All structural fill supporting the floor slab should be compacted to 95% of the maximum dry density (ASTM D 1557).

Concrete slabs placed on the subgrade, prepared as described herein, can be designed using a modulus of subgrade reaction of 150 pounds per cubic inch (pci).

Seismic Zone

According to the New Jersey Edition of the 2021 International Building Code, Section 1613.2.2 referencing ASCE 7, Chapter 20 the project site is categorized as a Site Class "D" for seismic design purposes (see attached). This classification is based on subsoil conditions encountered in the borings.

Limitations

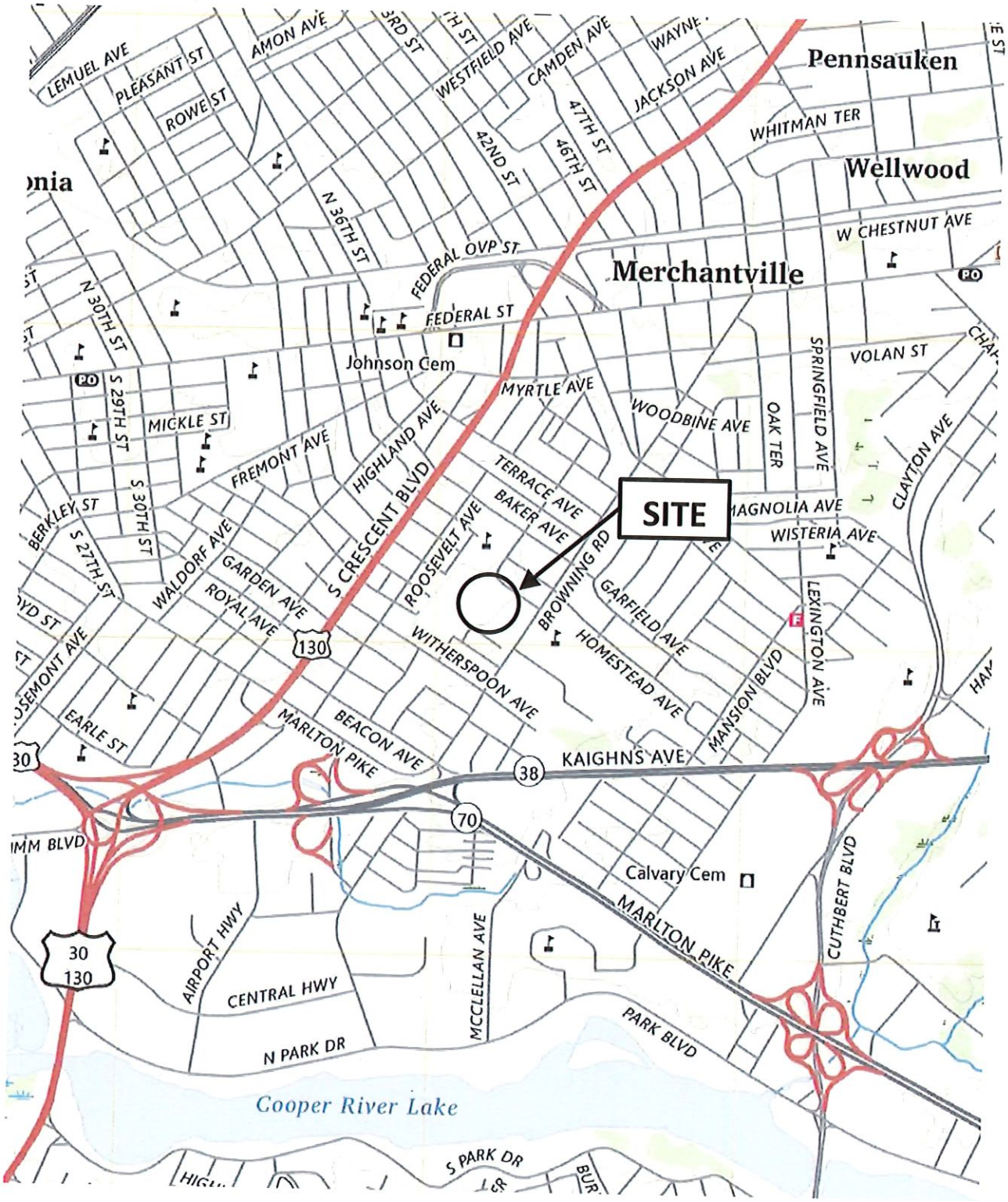
The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this investigation and on details stated in this report. It is understood that the number of test pits made are consistent with good engineering practice but actual conditions encountered may differ significantly from those projected in this report. Should conditions arise which differ from those described in this report, **RVE** should be notified immediately and provided with all information regarding differing subsurface conditions.

Our recommendations are based upon the assumption that the services of a qualified engineer will be retained during construction for the observation of all critical earthwork operations and foundation installation. **RVE** cannot minimize, or provide recommended solutions for, any problems resulting from construction or differing soil conditions unless our services include full-time construction inspection to determine that the work performed is in compliance with **RVE's** recommendations, and to ensure the work is carried out in the owner's best interests.

Environmental considerations and contaminants, such as petroleum products, hazardous waste, radioactivity, irritants, pollutants, radon or other dangerous substances and conditions were not the subject of this study. Their presence and/or absence are not implied, inferred or suggested by this report or results of this study.

This report is intended for use with regard to the specific project discussed herein, and any changes in the design of the structure or location, however slight, should be brought to our attention so that we may determine how they may affect our conclusions. We are responsible for the conclusions and opinions contained in this report based on the data relating only to the specific project and location discussed herein.

Site Location Map/USGS Quadrangle

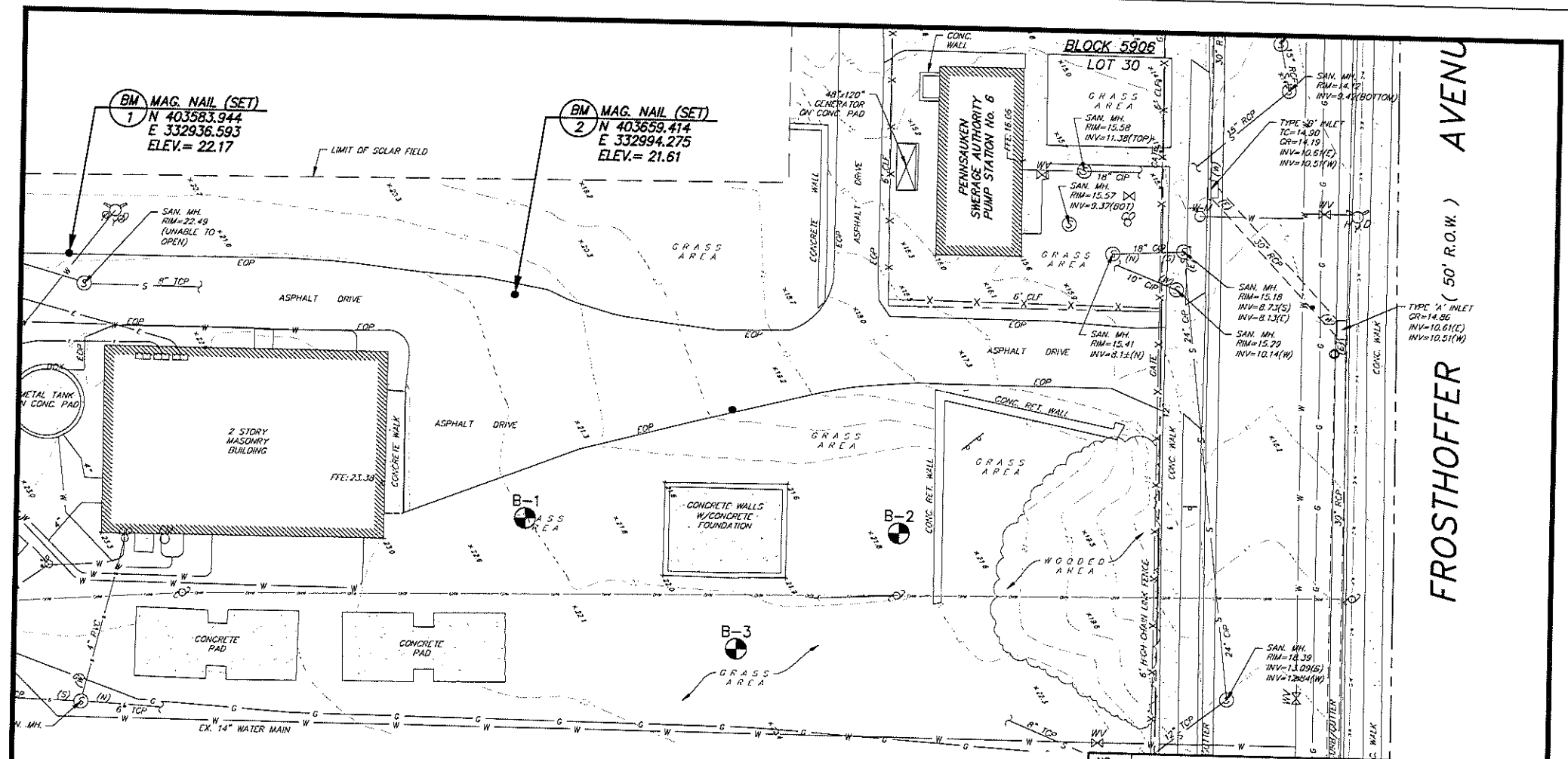


Site Location Map/USGS Quadrangle

MPWC Browning Road Water Treatment Plant Improvements

Township of Pennsauken, Camden County, New Jersey

Soil Boring Location Plan



B-1 **LEGEND**

DENOTES NUMBER AND APPROXIMATE LOCATION OF TEST BORINGS

N.J.P.C.S. NAD 1983

GRAPHIC SCALE

20 0 10 20

(IN FEET)

1 inch = 20 ft.

NO.	REVISION	DATE	BY	CHK. BY

BORING LOCATION PLAN

BROWNING ROAD WATER TREATMENT PLANT

PENNSAUKEN TOWNSHIP, CAMDEN COUNTY, NEW JERSEY

RVE

REMINGTON & VERNICK ENGINEERS GA 277045

2059 SPRINGDALE ROAD, CHERRY HILL, NJ 08002

(856) 795-9595, FAX (856) 795-1882, WEB SITE ADDRESS: WWW.RVE.COM

SCALE	DATE	DRAWN BY	DSGN. BY	CHK'D. BY	DWG. NO.	SHEET NO.
1"=20'	11/2023	C.O.G.	K.C.W.	K.C.W.		1 OF 1

DWG FILE PATH/NAME

Soil Test Boring Logs

REMINGTON & VERNICK ENGINEERS

SOIL BORING LOG

Project No. 0424M081 **Project** Browning Road Water Treatment Plant Improvements **Boring No.** B-1

Date Started: 10/26/34 **Location** 4430 Frosthoffer Avenue, Pennsauken, NJ **Sheet** 1 **of** 1

Date Finished: 10/26/23 **Client** Merchantville Pennsauken Water Commission **Surface Elev.** Ex. Grade

Drilling Contractor: Boring Brothers Inc. **Groundwater Data**

Drilling Method: Mud Rotary **Depth** 12 ft

Hammer Type: Automatic **Driller:** Matt Murtagh **Date** 10/26/23

Equipment: CME-75 Track Rig **Inspector:** Chris Gilbert **Time** During

Depth (ft.)	Sample Type	Sample Number	Blow Count (Blows per 6 inches)	Recovery	Lithology	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
0		S-1	6-5-8-2	10"		3" Topsoil over brown m-f SAND, little Silt, trace Clay, trace Cinders & Ash (Fill)			
		S-2	2-1-1-2	18"		Brown & orangish brown CLAYEY SILT, some f Sand			
5		S-3	5-4-10-8	14"		Light gray & light brown f SAND, trace Silt, trace Clay			
		S-4	10-10-12-20	16"		Mottled light gray, orangish brown & light brown f SAND, little Silt			
		S-5	25-39-44-47	20"		Mottled light gray, orangish brown & light brown f SAND, trace Silt			
10		S-6	48-49-50/5"	16"		Mottled light gray, orangish brown & light brown f SAND, trace Silt, trace f Gravel			
15		S-7	31-50/4"	8"		Light brown & gray f SAND, little Silt			
20		S-8	46-50/4"	9"					
25		S-9	50/4"	4"		Boring End at 25.33 Feet			
30									
35									

REMINGTON & VERNICK ENGINEERS

SOIL BORING LOG

Project No. 0424M081 **Project** Browning Road Water Treatment Plant Improvements **Boring No.** B-2

Date Started: 10/26/34 **Location** 4430 Frosthoffer Avenue, Pennsauken, NJ **Sheet** 1 **of** 1

Date Finished: 10/26/23 **Client** Merchantville Pennsauken Water Commission **Surface Elev.** Ex. Grade

Drilling Contractor: Boring Brothers Inc. **Groundwater Data**

Drilling Method: Mud Rotary **Depth** 12 ft

Hammer Type: Automatic **Driller:** Matt Murtagh **Date** 10/26/23

Equipment: CME-75 Track Rig **Inspector:** Chris Gilbert **Time** During

Depth (ft.)	Sample Type	Sample Number	Blow Count (Blows per 6 inches)	Recovery	Lithology	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
0		S-1	3-6-5-5	18"		3" Topsoil over brown CLAYEY SILT, little f Sand, trace f Crushed Stone (Fill)			
		S-2	2-2-1-2	16"		Brown f SAND, some Silt, little Clay, trace Cinders & Ash (Fill)			
5		S-3	8-11-8-8	14"		Light gray & light brown SILT, little f Sand, little Clay			
		S-4	13-15-15-19	18"		Light gray & light brown m-f SAND, trace Silt			
		S-5	23-29-40-48	20"					
10		S-6	33-50/4"	5"					
15		S-7	39-50/3"	8"		Light gray & light brown f SAND, little Silt			
20		S-8	50/5"	3"					
25		S-9	50/3"	3"		Boring End at 25.25 Feet			
30									
35									

REMINGTON & VERNICK ENGINEERS

SOIL BORING LOG

Project No. 0424M081 **Project** Browning Road Water Treatment Plant Improvements **Boring No.** B-3

Date Started: 10/26/34 **Location** 4430 Frosthoffer Avenue, Pennsauken, NJ **Sheet** 1 **of** 2

Date Finished: 10/26/23 **Client** Merchantville Pennsauken Water Commission **Surface Elev.** Ex. Grade

Drilling Contractor: Boring Brothers Inc. **Groundwater Data**

Drilling Method: Mud Rotary **Depth** 12 ft

Hammer Type: Automatic **Driller:** Matt Murtagh **Date** 10/26/23

Equipment: CME-75 Track Rig **Inspector:** Chris Gilbert **Time** During

Depth (ft.)	Sample Type	Sample Number	Blow Count (Blows per 6 inches)	Recovery	Lithology	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
0		S-1	4-4-3-3	20"		6" Topsoil over light brown f SAND, trace Silt			
		S-2	3-3-5-5	14"		Orangish brown CLAYEY SILT, some f Sand			
5		S-3	7-16-17-18	16"		Orangish brown, brown and light brown m- f SAND, little f Gravel, little Silt, trace Clay			
		S-4	20-21-17-14	10"		Mottled light gray & light brown SILT, little f SAND, little Clay			
		S-5	18-20-19-20	20"		Mottled light gray & light brown f SAND, trace Silt			
10		S-6	28-34-50/5"	14"					
15		S-7	40-50/4"	5"		Light gray & light brown m-f SAND, little Silt			
20		S-8	50/5"	3"		Light gray & light brown f SAND, little Silt, trace f Gravel			
25		S-9	34-50/5"	9"		Light gray & light brown f SAND, trace Silt, trace f Gravel			
30		S-10	50/5"	3"		Light gray and light brown c-f SAND, little f Gravel, little Silt			
35									

REMINGTON & VERNICK ENGINEERS

SOIL BORING LOG

Project No. 0424M081 **Project** Browning Road Water Treatment Plant Improvements **Boring No.** B-3

Date Started: 10/26/34 **Location** 4430 Frosthoffer Avenue, Pennsauken, NJ **Sheet** 2 **of** 2

Date Finished: 10/26/23 **Client** Merchantville Pennsauken Water Commission **Surface Elev.** Ex. Grade

Drilling Contractor: Boring Brothers Inc. **Groundwater Data**

Drilling Method: Mud Rotary **Depth** 12 ft

Hammer Type: Automatic **Driller:** Matt Murtagh **Date** 10/26/23

Equipment: CME-75 Track Rig **Inspector:** Chris Gilbert **Time** During

Depth (ft.)	Sample Type	Sample Number	Blow Count (Blows per 6 inches)	Recovery	Lithology	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
		S-11	44-49-50/5"	16"		Layered light brown & orangish brown m- f SAND, little Silt			
40		S-12	20-17-10-10	14"		Layered dark brown, brown, light brown & orangish brown m-f SAND, little Silt			
45		S-13	3-11-22-29	16"		Brown and orangish brown c-f SAND, little Silt			
50		S-14	32-40-49-49	12"					
						Boring End at 52 Feet			
55									
60									
65									
70									

MODIFIED METHOD
FOR
IDENTIFICATION OF SOILS
AFTER
DR. D. M. BURMISTER

Soil Component	Descriptive Terms As Written on Log	Range of Proportions
PRINCIPAL COMPONENT (All Letters Capitalized)	-	35% or more
MINOR COMPONENTS (First Letter Capitalized)	and (a.)	35% to 50%
	some (s.)	20% to 35%
	little (l.)	10% to 20%
	trace (tr.)	1% to 10%

Coarse Grained Soils-Gradation of Components

Coarse to fine	cf	All sizes
Coarse to medium	cm	Less than 10% fine
Medium to fine	mf	Less than 10% coarse
Coarse	c	Less than 10% medium & fine
Medium	m	Less than 10% coarse & fine
Fine	f	Less than 10% coarse & medium

Component	Symbol	Sieve Range
Boulders		9" and larger
Cobbles		3" to 9"
Gravel	G	
Coarse		¾" to 3"
Fine		#4 to ¾"
Sand	S	
Coarse		#4 to #10
Medium		#10 to #40
Fine		#40 to #200

Fine Grained Soils-Plasticity of Components

Component	Symbol	Overall Plasticity	Plasticity Index
SILT	S	Non-Plastic	0
CLAYEY SILT	CyS	Slight	1 to 5
SILT & CLAY	S & C	Low	5 to 10
CLAY & SILT	C & S	Medium	10 to 20
SILTY CLAY	SyC	High	20 to 40
CLAY	C	Very High	over 40

UNIFIED SOIL CLASSIFICATION SYSTEM. (ASTM D-2487)

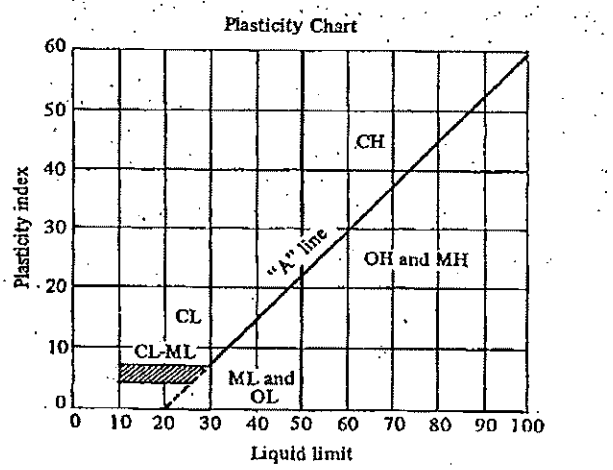
Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mix-tures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. Less than 4
			GC	Clayey gravels, gravel-sand-clay mix-tures	Atterberg limits below "A" line with P.I. Greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. Less than 4
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. Greater than 7
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

	Borderline cases requiring dual symbols[b]
Less than 5 per cent	GW, GP, SW, SP
More than 12 per cent	GM, GC, SM, SC
5 to 12 per cent	

Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols

Limits plotting in hatched zone with P.I. Between 4 and 7 are *borderline* cases requiring use of dual symbols



[a]Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. Is 6 or less; the suffix u used when L.L. is greater than 28.

[b]Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

Normalized N-Values

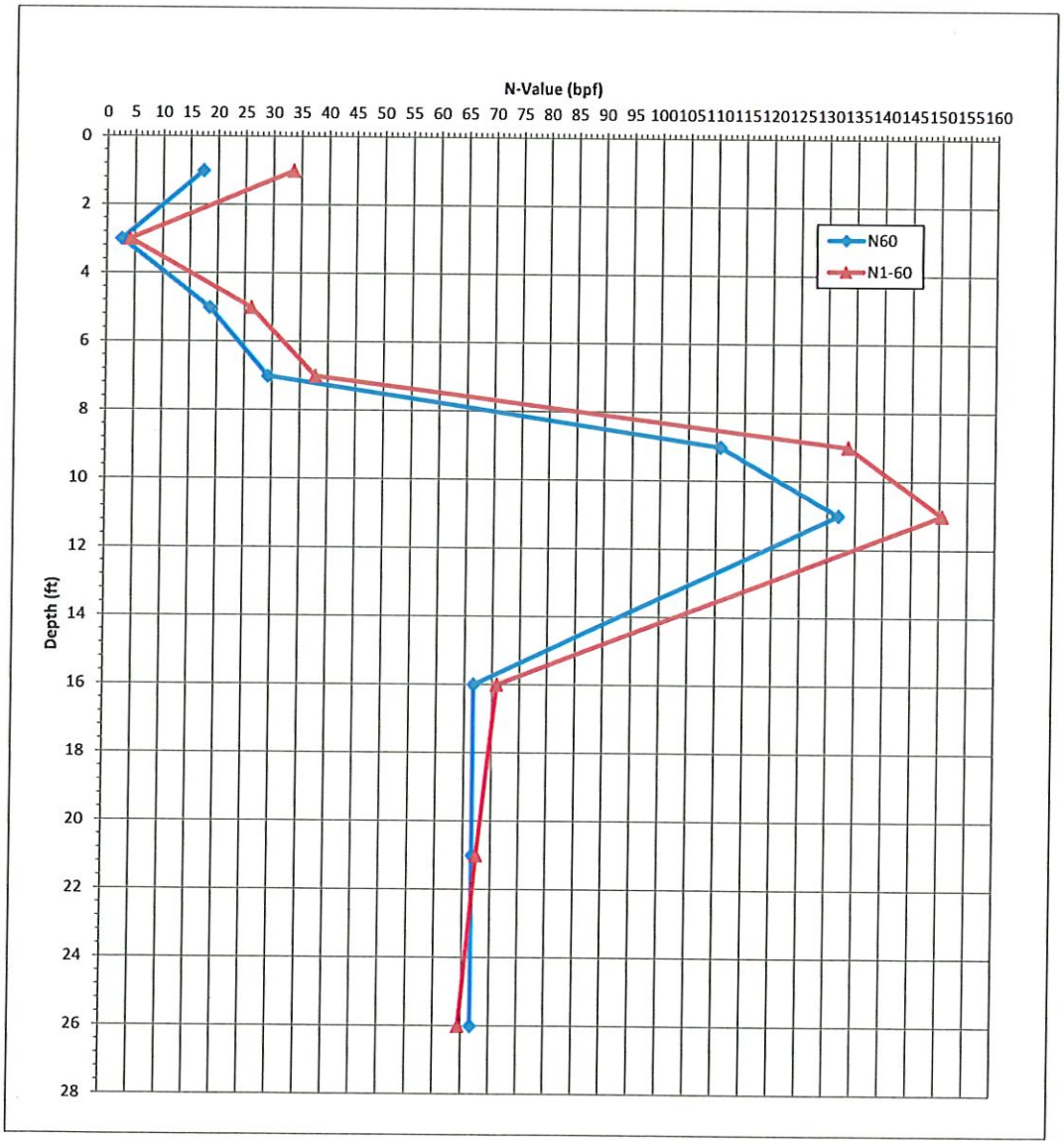
NORMALIZED N VALUES

MPWC Browning Road Water Treatment Plant Improvments
Pennsauken, NJ

Boring No.	B-1
Elevation, ft	0
Groundwater Depth, ft	12
Hammer Type	Automatic
Hammer Efficiency, E	0.8

Formulas used	$N60 = N(E/.6)$
	$\sigma' = \sigma t - u$
	$CN = .77\log(40/\sigma')$ $CN < 2$ Only valid for $\sigma' \geq 0.5$ ksf
	$N160 = N60*CN$

Sample Number	Sample Depth	N-value Recored			N_{60}	γ	σt	u	σ'	CN	N160
		Depth	Elev.	Value		pcf	ksf	ksf	ksf		
1	0 - 2	1	-1	13	17	120	0.12	0.00	0.12	1.94	34
2	2 - 4	3	-3	2	3	120	0.36	0.00	0.36	1.58	4
3	4 - 6	5	-5	14	19	120	0.60	0.00	0.60	1.40	26
4	6 - 8	7	-7	22	29	120	0.84	0.00	0.84	1.29	38
5	8 - 10	9	-9	83	111	120	1.08	0.00	1.08	1.21	134
6	10 - 12	11	-11	99	132	120	1.32	0.00	1.32	1.14	151
7	15 - 17	16	-16	50	67	120	1.92	0.26	1.66	1.06	71
8	20 - 22	21	-21	50	67	120	2.52	0.58	1.94	1.01	67
9	25 - 27	26	-26	50	67	120	3.12	0.90	2.22	0.97	64



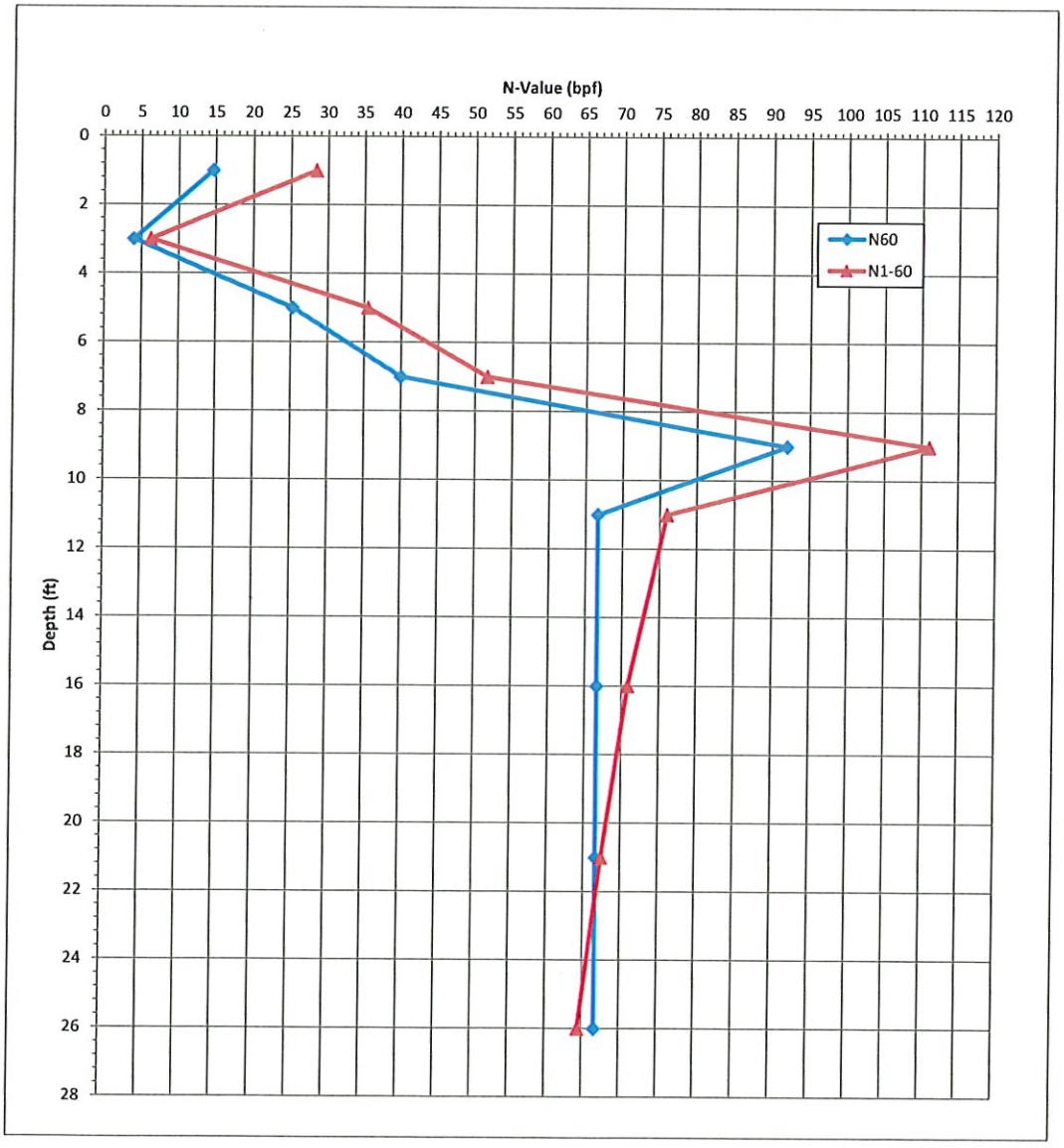
NORMALIZED N VALUES

MPWC Browning Road Water Treatment Plant Improvments
Pennsauken, NJ

Boring No.	B-2
Elevation, ft	0
Groundwater Depth, ft	12
Hammer Type	Automatic
Hammer Efficiency, E	0.8

Formulas used	N60 = N(E/.6)
	σ' = σt - u
	CN = .77log(40/σ') CN < 2 Only valid for σ' ≥ 0.5 ksf
	N160 = N60*CN

Sample Number	Sample Depth	N-value Recored			N_{60}	γ	σt	u	σ'	CN	N160
		Depth	Elev.	Value		pcf	ksf	ksf	ksf		
1	0 - 2	1	-1	11	15	120	0.12	0.00	0.12	1.94	28
2	2 - 4	3	-3	3	4	120	0.36	0.00	0.36	1.58	6
3	4 - 6	5	-5	19	25	120	0.60	0.00	0.60	1.40	36
4	6 - 8	7	-7	30	40	120	0.84	0.00	0.84	1.29	52
5	8 - 10	9	-9	69	92	120	1.08	0.00	1.08	1.21	111
6	10 - 12	11	-11	50	67	120	1.32	0.00	1.32	1.14	76
7	15 - 17	16	-16	50	67	120	1.92	0.26	1.66	1.06	71
8	20 - 22	21	-21	50	67	120	2.52	0.58	1.94	1.01	67
9	25 - 27	26	-26	50	67	120	3.12	0.90	2.22	0.97	64



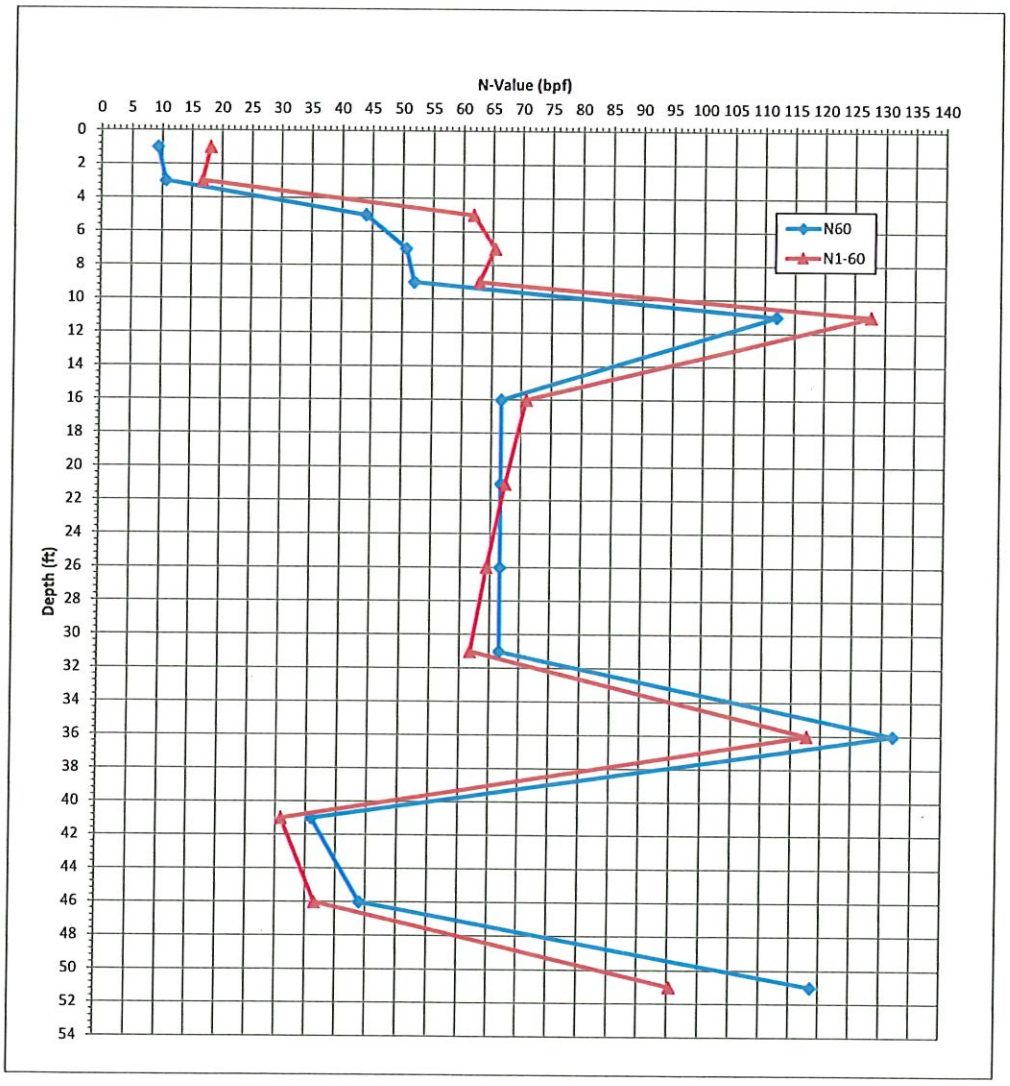
NORMALIZED N VALUES

MPWC Browning Road Water Treatment Plant Improvments
Pennsauken, NJ

Boring No.	B-3
Elevation, ft	0
Groundwater Depth, ft	12
Hammer Type	Automatic
Hammer Efficiency, E	0.8

Formulas used	N60 = N(E/.6)
	$\sigma' = \sigma t - u$
	$CN = .77\log(40/\sigma')$ $CN < 2$ Only valid for $\sigma' \geq 0.5$ ksf
	N160 = N60*CN

Sample Number	Sample Depth	N-value Recored			N_{60}	γ	σt	u	σ'	CN	N160
		Depth	Elev.	Value		pcf	ksf	ksf	ksf		
1	0 - 2	1	-1	7	9	120	0.12	0.00	0.12	1.94	18
2	2 - 4	3	-3	8	11	120	0.36	0.00	0.36	1.58	17
3	4 - 6	5	-5	33	44	120	0.60	0.00	0.60	1.40	62
4	6 - 8	7	-7	38	51	120	0.84	0.00	0.84	1.29	65
5	8 - 10	9	-9	39	52	120	1.08	0.00	1.08	1.21	63
6	10 - 12	11	-11	84	112	120	1.32	0.00	1.32	1.14	128
7	15 - 17	16	-16	50	67	120	1.92	0.26	1.66	1.06	71
8	20 - 22	21	-21	50	67	120	2.52	0.58	1.94	1.01	67
9	25 - 27	26	-26	50	67	120	3.12	0.90	2.22	0.97	64
10	30 - 32	31	-31	50	67	120	3.72	1.22	2.50	0.93	62
11	35 - 37	36	-36	99	132	120	4.32	1.54	2.78	0.89	118
12	40 - 42	41	-41	27	36	120	4.92	1.86	3.06	0.86	31
13	45 - 47	46	-46	33	44	120	5.52	2.18	3.34	0.83	37
14	50 - 52	51	-51	89	119	120	6.12	2.50	3.62	0.80	95



Laboratory Testing Results

SUMMARY OF LABORATORY TEST DATA

Project Name: MPWC Browning Road WTP Improvements
RVE# 0424M081
Client Name: Remington & Vernick Engineers, Inc.
TRC Project #: 580415

SAMPLE IDENTIFICATION			Soil Group (USCS System)	Moisture Content (%)	GRAIN SIZE DISTRIBUTION (USCS GRADATION)				PLASTICITY			
Source #	Sample #	Depth (ft)			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-1	S-2	6.0-8.0	CL[1]	17.7	-	-	-		26	15	11	0.2
B-1	S-4	10.0-12.0	SM[2]	8.5	0.0	84.1	15.9		-	-	-	-
B-2	S-3	4.0-6.0	ML[2]	12.1	0.0	19.6	80.4		-	-	-	-
B-2	S-5	8.0-10.0	SP-SM[2]	4.7	0.0	94.0	6.0		-	-	-	-
B-3	S-2	2.0-4.0	ML[2]	17.3	0.0	29.5	53.4	17.1	-	-	-	-
B-3	S-3	4.0-6.0	SM[2]	8.2	14.3	61.9	23.8		-	-	-	-
B-3	S-4	6.0-8.0	ML[1]	12.5	0.0	13.7	86.3		-	-	-	-

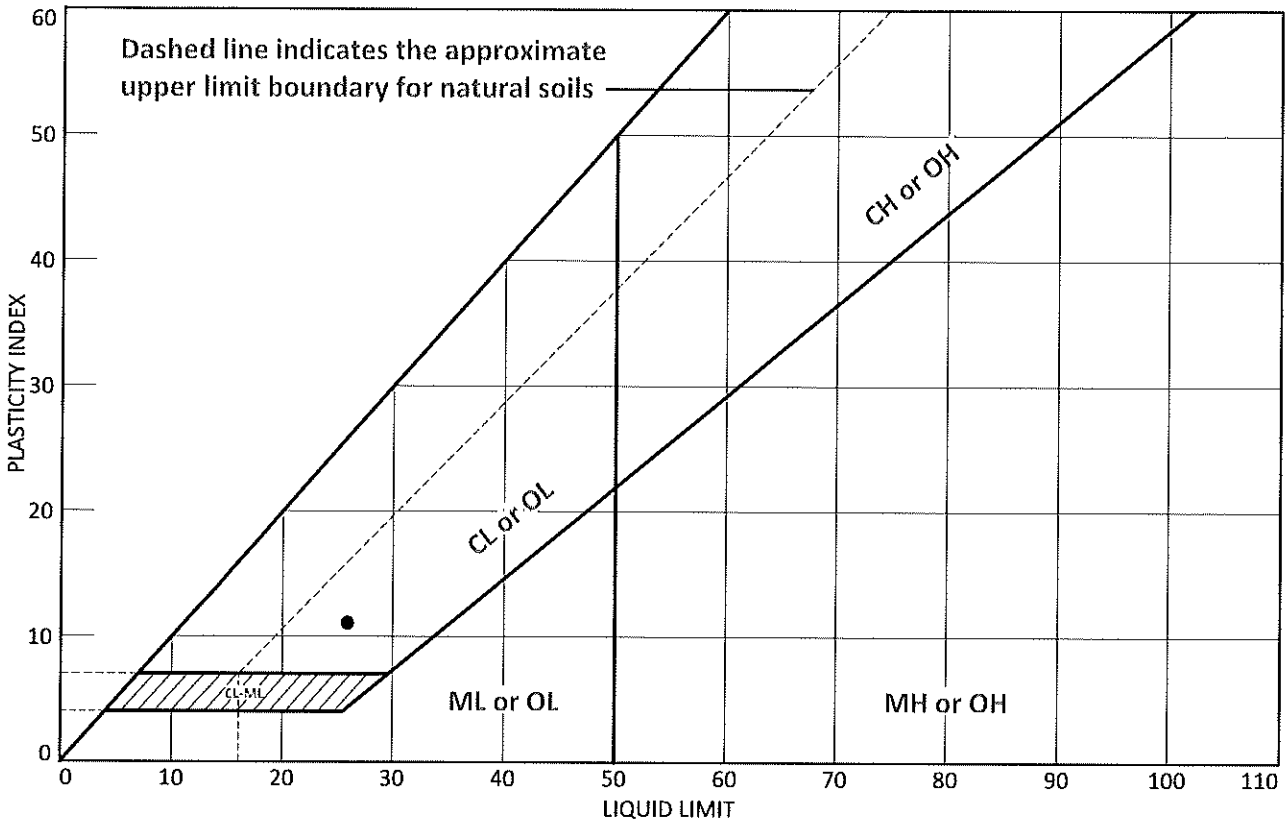
Notes:

1. *USCS based on fines only. No grain-size distribution was requested to be completed.*
2. *USCS based on grain-size distribution and visual classification. An Atterberg limits was not requested to be completed.*

DRAWN BY: TBT 12/11/23

CHECKED BY: JPB 12/11/23

Atterberg Limits and Moisture Content Report



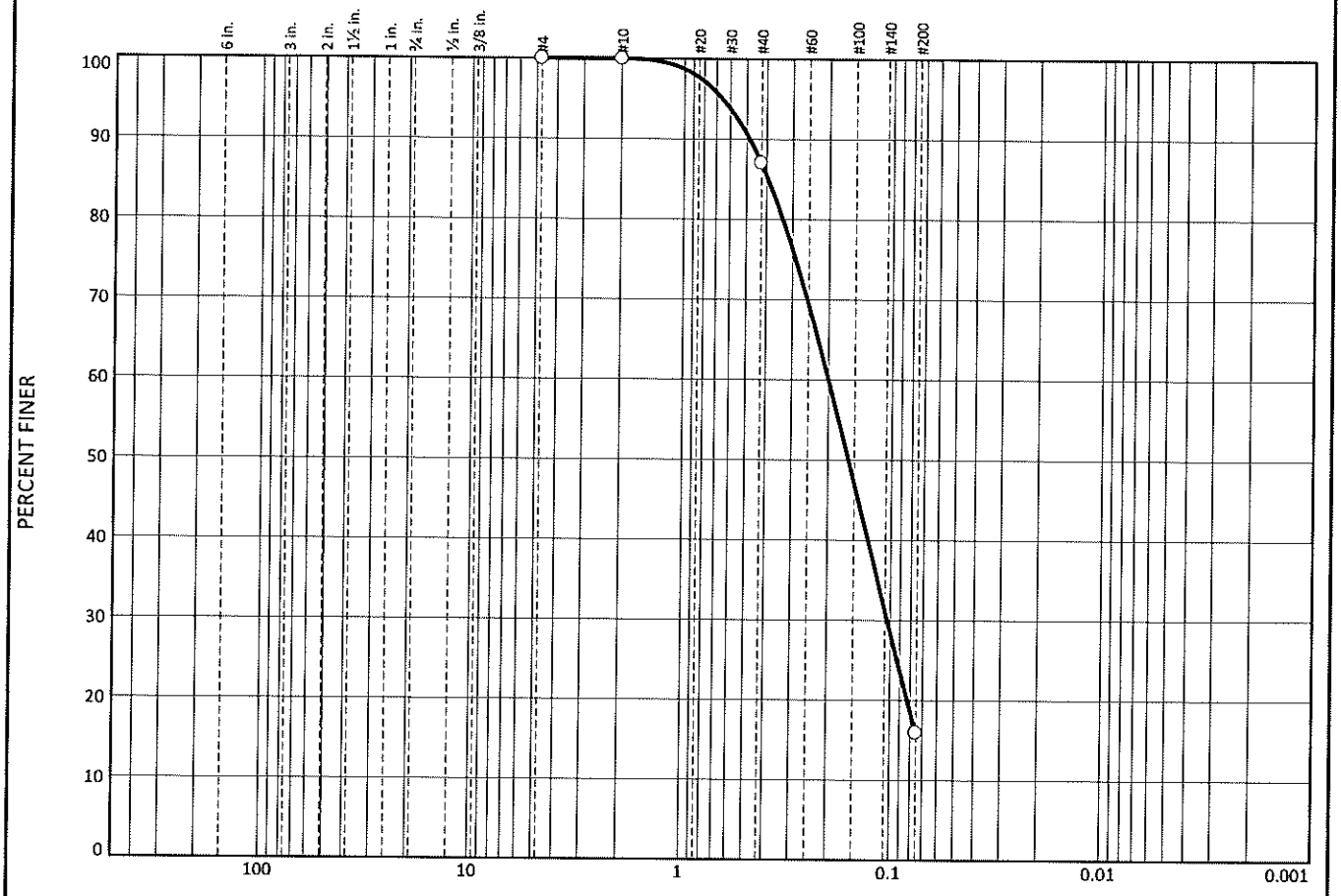
SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	B-1	S-2	2.0-4.0 FT	17.7	15	26	11	0.2	CL*

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: REMINGTON & VERNICK ENGINEERS, INC.
Project: MPWC BROWNING ROAD WTP IMPROVEMENTS
RVE # 0424M081
Project No.: 580415 **Figure** 1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	13.0	71.1	15.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3930	0.1996	0.1599	0.1036				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ LIGHT BROWN SILTY SAND	12/06/23	SM	8.5

Project No. 580415 **Client:** REMINGTON & VERNICK ENGINEERS, INC.

Project: MPWC BROWNING ROAD WTP IMPROVEMENTS

RVE # 0424M081

○ **Source of Sample:** B-1 **Depth:** 6.0-8.0 FT **Sample Number:** S-4

TRC Engineers, Inc.

Mt. Laurel, NJ

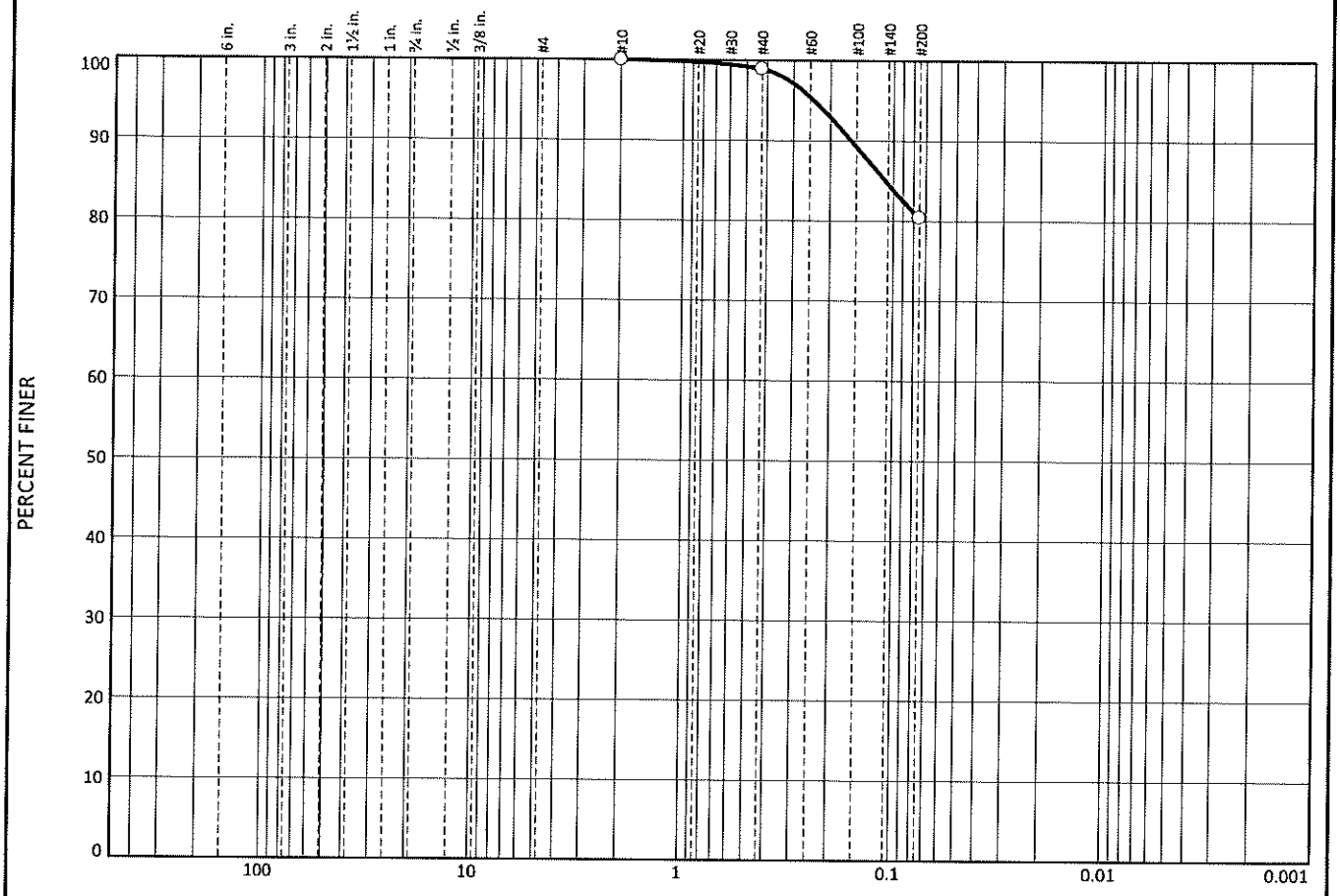
Remarks:

○SAMPLE DESCRIPTION BASED ON GRAIN-SIZE DISTRIBUTION AND VISUAL CLASSIFICATION

Figure 2

Tested By: OA 12/06/23 **Checked By:** JPB 12/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.1	18.5	80.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1094							

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY-BROWN SILT WITH SAND	12/06/23	ML	12.1

Project No. 580415 **Client:** REMINGTON & VERNICK ENGINEERS, INC.

Project: MPWC BROWNING ROAD WTP IMPROVEMENTS

RVE # 0424M081

○ **Source of Sample:** B-2 **Depth:** 4.0-6.0 FT **Sample Number:** S-3

TRC Engineers, Inc.

Mt. Laurel, NJ

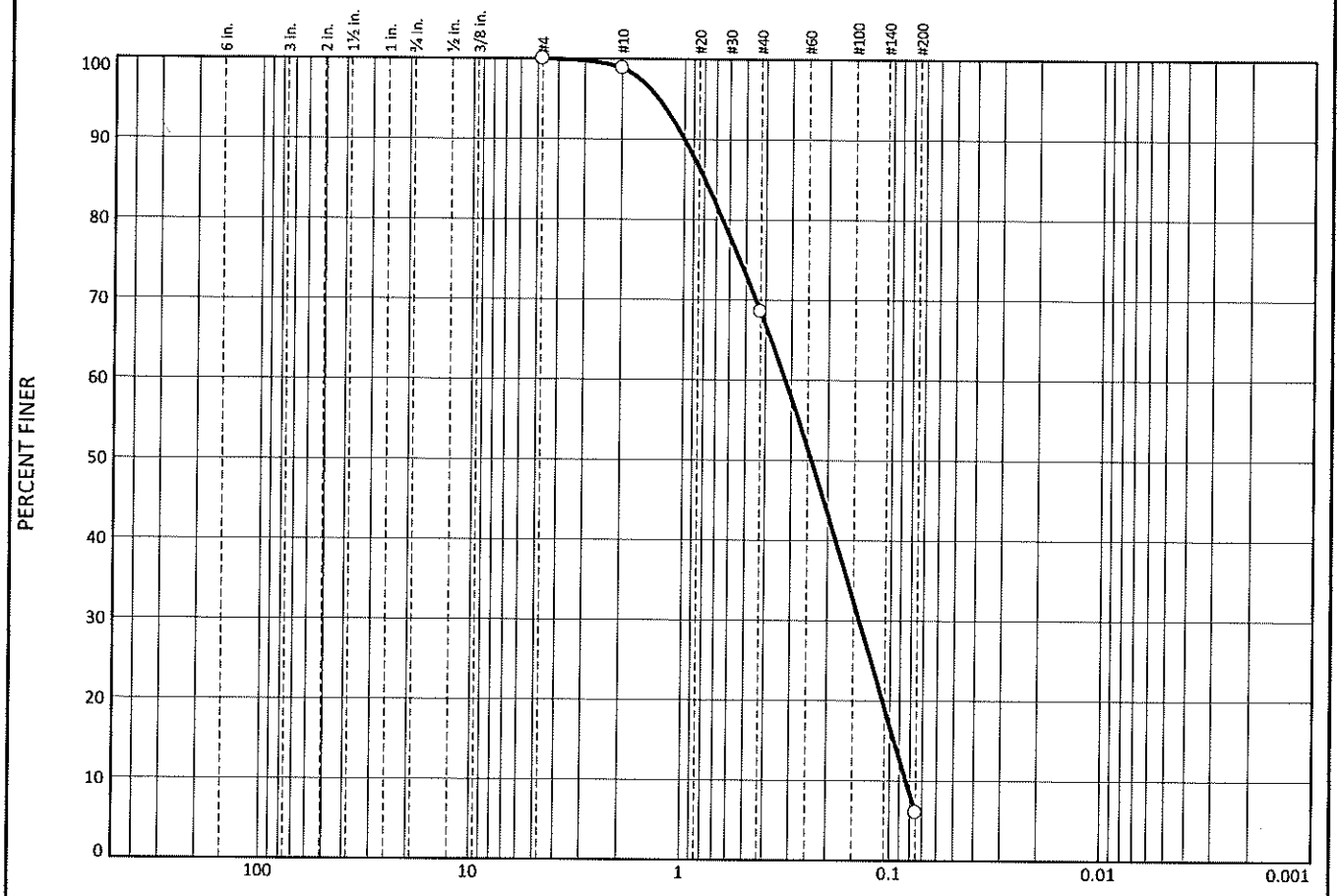
Remarks:

○SAMPLE DESCRIPTION BASED ON GRAIN-SIZE DISTRIBUTION AND VISUAL CLASSIFICATION

Figure 3

Tested By: OA 12/06/23 **Checked By:** JPB 12/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.2	30.2	62.6	6.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7953	0.3202	0.2394	0.1410	0.0955	0.0836	0.74	3.83

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ LIGHT BROWN POORLY GRADED SAND WITH SILT	12/06/23	SP-SM	4.7

Project No. 580415 **Client:** REMINGTON & VERNICK ENGINEERS, INC.

Project: MPWC BROWNING ROAD WTP IMPROVEMENTS

RVE # 0424M081

○ **Source of Sample:** B-2 **Depth:** 8.0-10.0 FT **Sample Number:** S-5

Remarks:

○SAMPLE DESCRIPTION BASED ON GRAIN-SIZE DISTRIBUTION AND VISUAL CLASSIFICATION

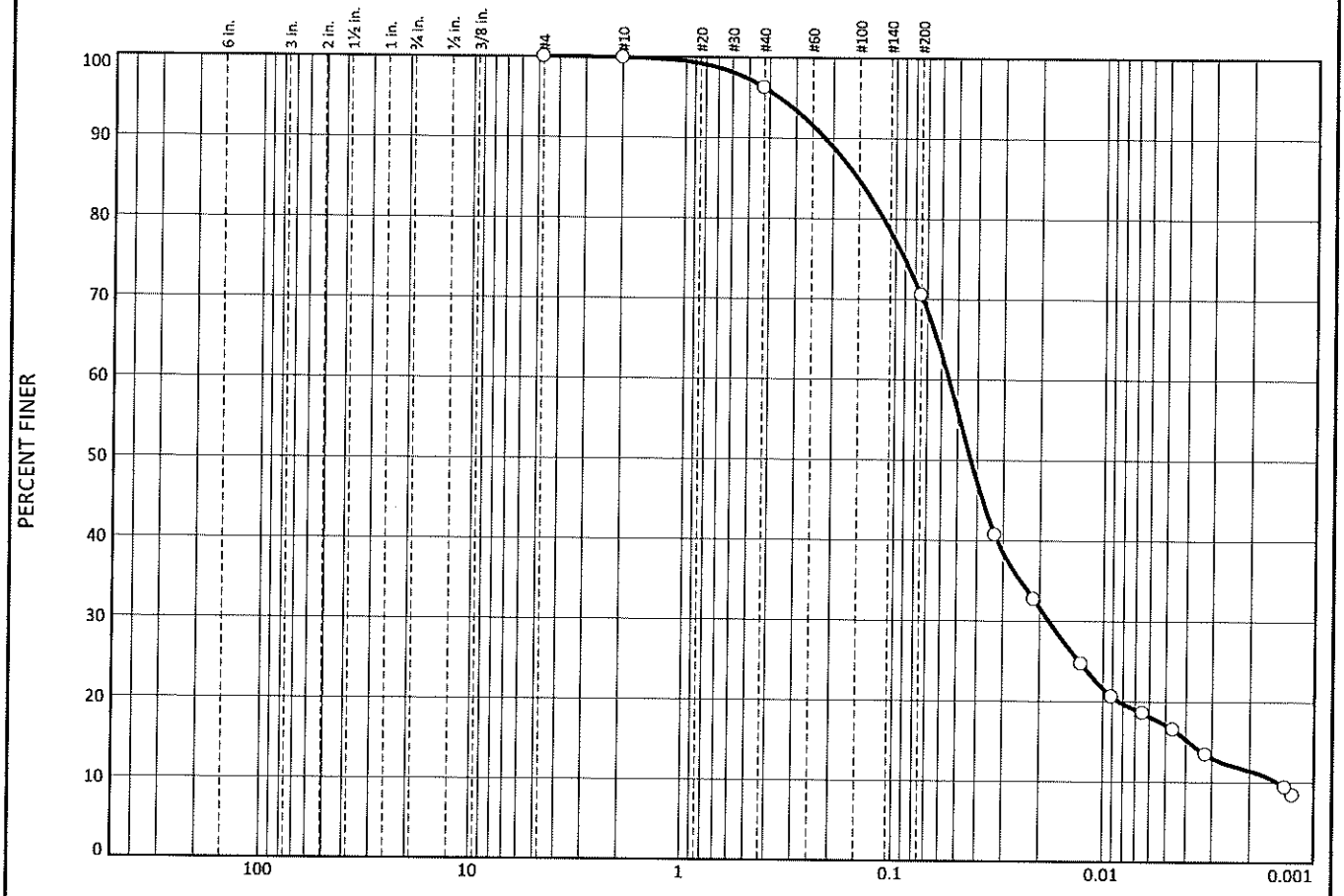
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 4

Tested By: OA 12/06/23 **Checked By:** JPB 12/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	3.6	25.8	53.4	17.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1520	0.0550	0.0430	0.0181	0.0039	0.0015	4.05	37.36

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILT WITH SAND	12/09/23	ML	17.3

Project No. 580415 **Client:** REMINGTON & VERNICK ENGINEERS, INC.

Project: MPWC BROWNING ROAD WTP IMPROVEMENTS

RVE # 0424M081

○ **Source of Sample:** B-3 **Depth:** 2.0-4.0 FT **Sample Number:** S-2

Remarks:

○SAMPLE DESCRIPTION BASED ON GRAIN-SIZE DISTRIBUTION AND VISUAL CLASSIFICATION

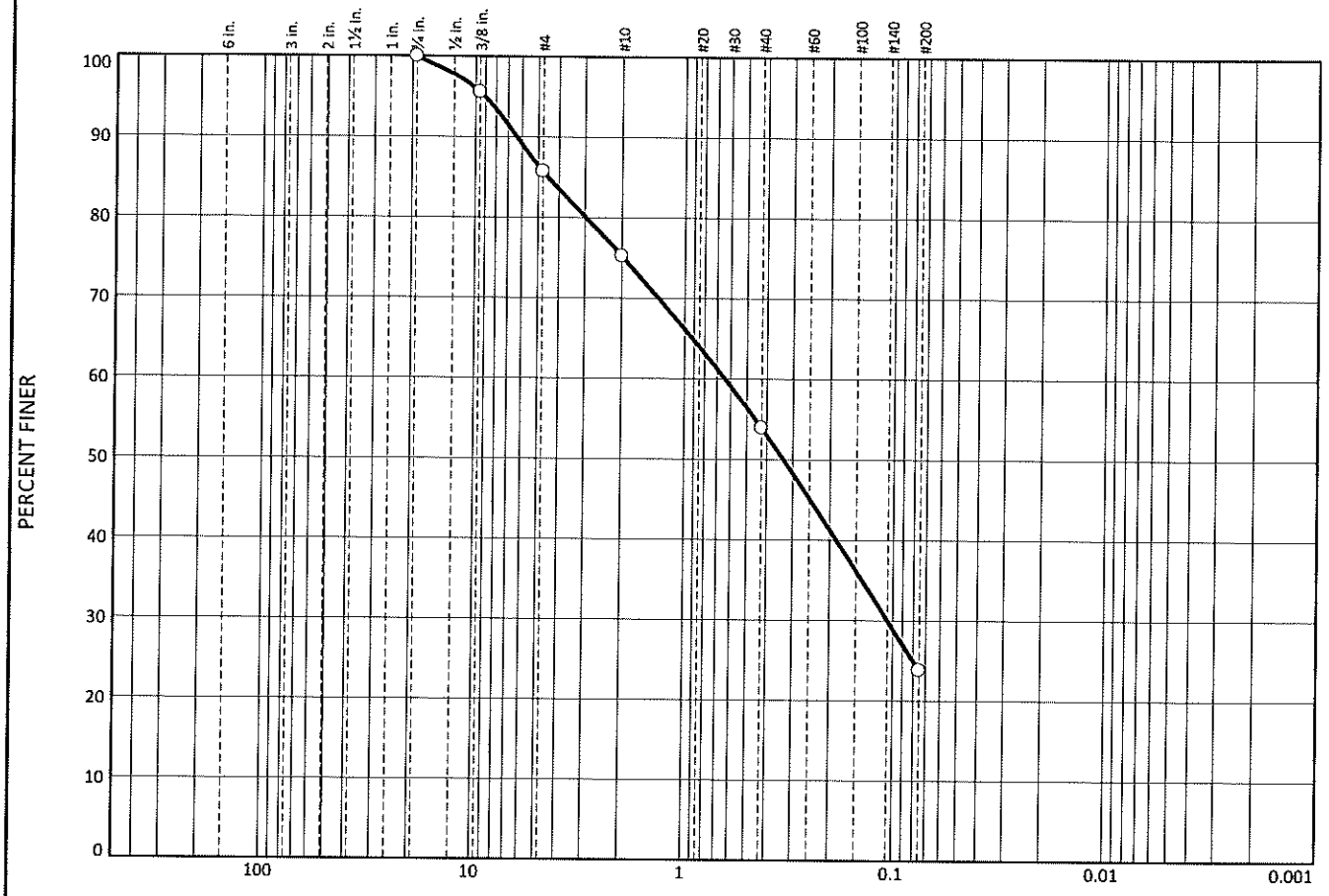
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 5

Tested By: OA 12/09/23 **Checked By:** JPB 12/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	14.3	10.5	21.3	30.1	23.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			4.4953	0.6389	0.3327	0.1065				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ ORANGE-BROWN SILTY SAND	12/06/23	SM	8.2

Project No. 580415 **Client:** REMINGTON & VERNICK ENGINEERS, INC.

Project: MPWC BROWNING ROAD WTP IMPROVEMENTS

RVE # 0424M081

○ **Source of Sample:** B-3 **Depth:** 4.0-6.0 FT **Sample Number:** S-3

TRC Engineers, Inc.

Mt. Laurel, NJ

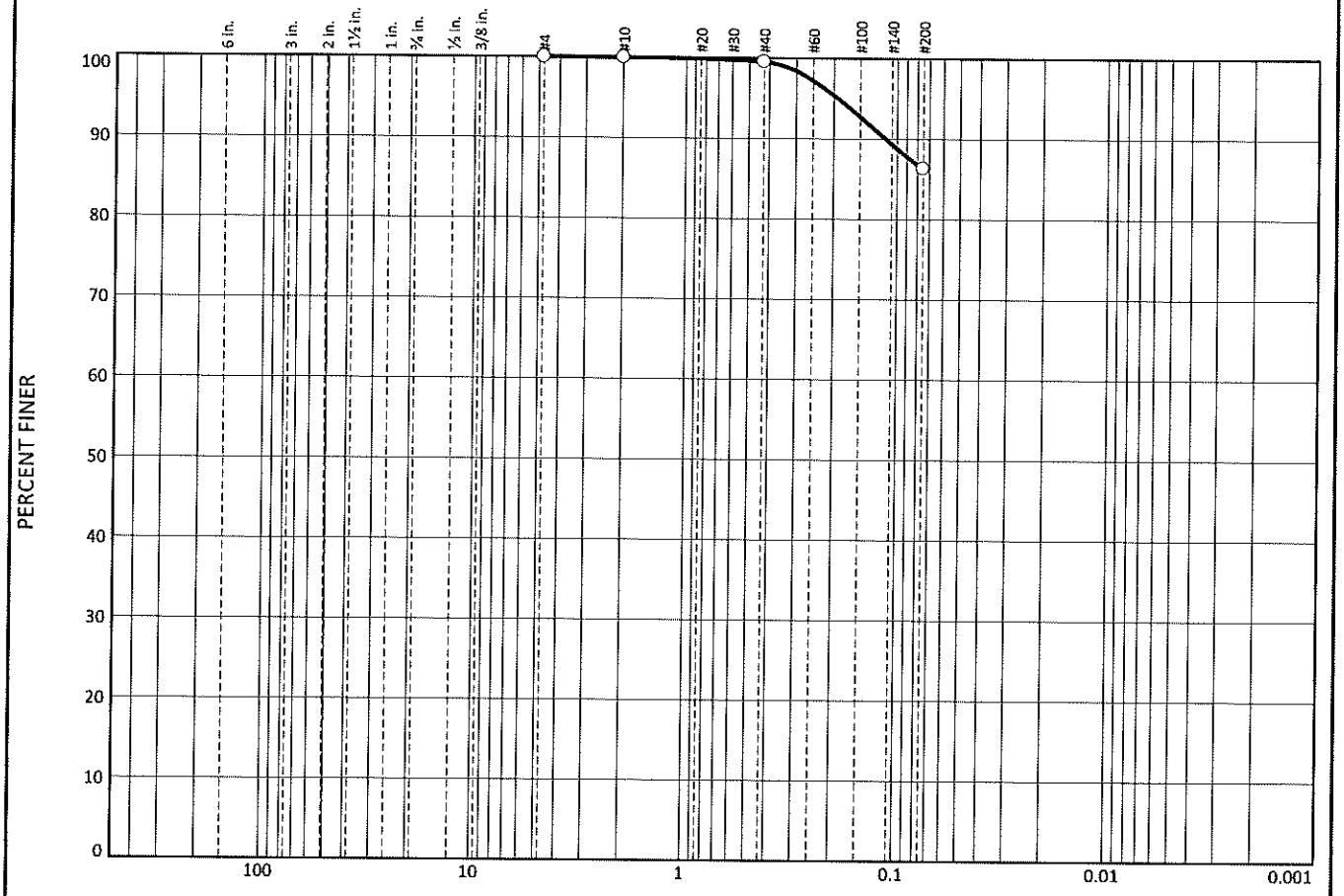
Remarks:

○SAMPLE DESCRIPTION BASED ON GRAIN-SIZE DISTRIBUTION AND VISUAL CLASSIFICATION

Figure 6

Tested By: OA 12/06/23 **Checked By:** JPB 12/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	13.2	86.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ LIGHT BROWN SILT	12/06/23	ML	12.5

Project No. 580415 **Client:** REMINGTON & VERNICK ENGINEERS, INC.

Project: MPWC BROWNING ROAD WTP IMPROVEMENTS

RVE # 0424M081

○ **Source of Sample:** B-3 **Depth:** 6.0-8.0 FT **Sample Number:** S-4

Remarks:

○SAMPLE DESCRIPTION BASED ON GRAIN-SIZE DISTRIBUTION AND VISUAL CLASSIFICATION

TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 7

Tested By: OA 12/06/23 **Checked By:** JPB 12/11/23

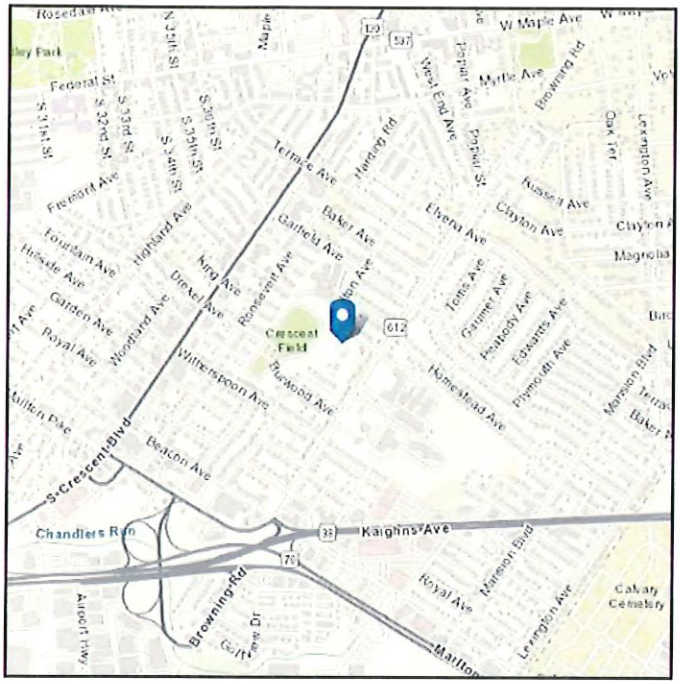
Seismic Information

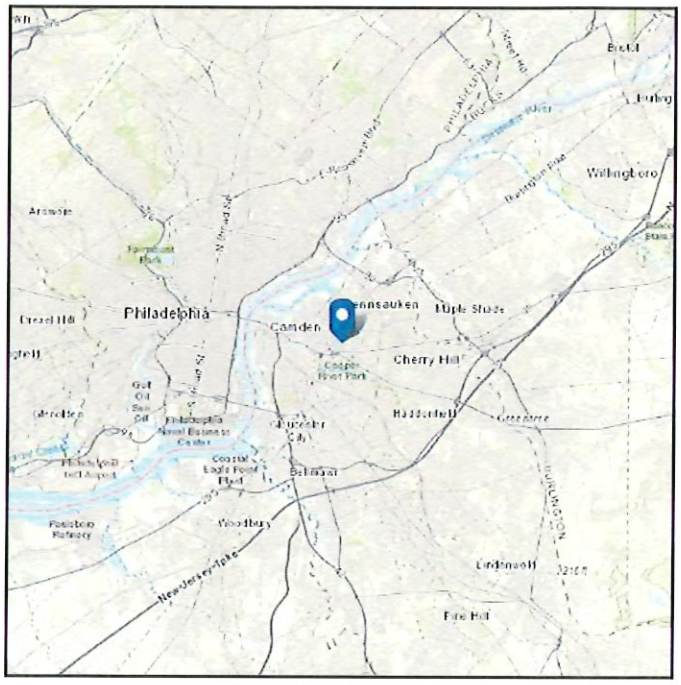
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-22
Risk Category: III
Soil Class: D - Stiff Soil

Latitude: 39.940384
Longitude: -75.067632
Elevation: 18.39993096609436 ft (NAVD 88)





ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

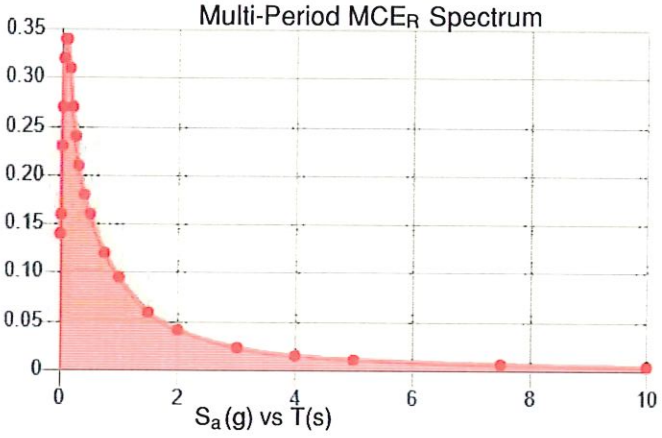
D - Stiff Soil

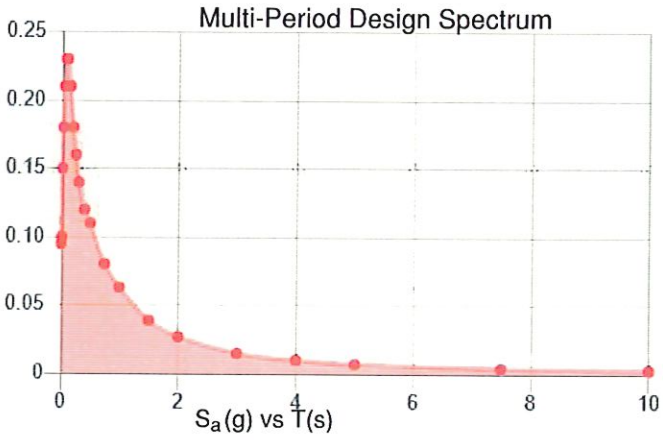
Site Soil Class:

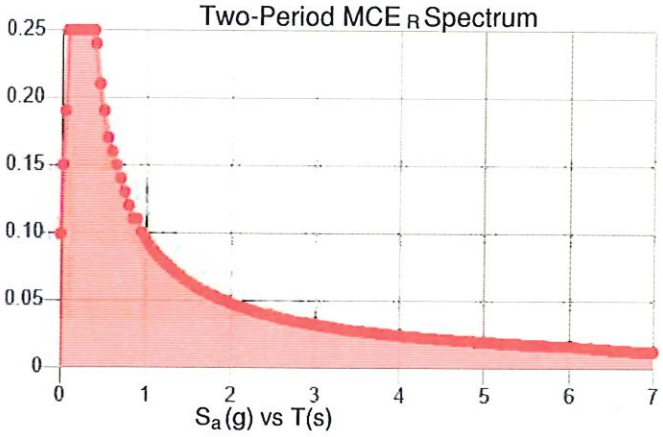
Results:

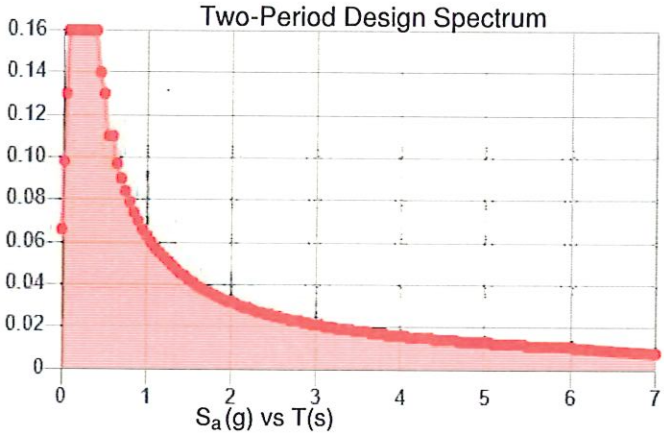
PGA_M :	0.13	T_L :	6
S_{MS} :	0.25	S_S :	0.21
S_{M1} :	0.095	S_1 :	0.045
S_{DS} :	0.16	V_{S30} :	260
S_{D1} :	0.063		

Seismic Design Category: A









MCER Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: Wed Nov 22 2023

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

APPENDIX B

CAMDEN COUNTY SOIL CONSERVATION DISTRICT CERTIFICATION

Camden County Soil Conservation District

408 Commerce Lane
West Berlin NJ 08091
856.767.6299
www.camdenscd.org

CERTIFICATION

Merchantville Pennsauken Water Commission
6751 Westfield Ave.
Pennsauken, NJ 08110

Enclosed is a copy of your certified Soil Erosion and Sediment Control Plan for the referenced project signed by a member of the District Board of Supervisors pursuant to the New Jersey Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et. seq., Chapter 251, P.L. 1975.

CERTIFICATION DATE: 09-23-2024 EXPIRATION DATE: 03-24-2028

PLAN DATE: 03-01-2024 LAST REVISION DATE: ----

PROJECT: Browing Road Water Treatment Plant Improvements
Application #2024-7614
Block 5906 Lot 29
4400 Frosthoffer Ave.
Pennsauken Township

The requirements of this certification are as follows:

1. The District must be notified 72 hours in advance of start of any land disturbance.

2. Certified copy of the Soil Erosion and Sediment Control Plan must be on site.

3. All revisions and municipal renewals of this project will require resubmission and approval by the District.

4. Any conveyance of the project (or portion thereof) will transfer full responsibility for compliance to subsequent owner(s). The District must be notified in writing of any change of ownership.

5. No Certificates of Occupancy, temporary or permanent, will be issued by a municipality until a Certificate of Compliance is issued by the District.

This certification is limited to the controls specified in this referenced plan. It is not authorization to engage in the proposed land use unless such use has been previously approved by the municipality or other controlling agency.

Conditions:

Distribution: Applicant
Construction Official
Engineer
District

Camden County SCD
408 Commerce Lane
West Berlin NJ 08091
856.767.6299
www.camdenscd.org

For District Use Only

Application No: **7614-PE-24**
Received: 8/28/24
Site Plan

APPLICATION FOR SOIL EROSION AND SEDIMENT CONTROL PLAN CERTIFICATION

The enclosed soil erosion and sediment control plan and supporting information are submitted for certification pursuant to the Soil Erosion and Sediment Control Act, Chapter 251, P.L. 1975 as amended (NJSA 4:24-39 et. seq.) An application for certification of a soil erosion and sediment control plan shall include the items listed on the reverse side of this form.

Name of Project: Browning Road Water Treatment Plant Improvements		Project Location: Municipality: Pennsauken Township	
Project Street Address: 4400 Frosthoffer Avenue, Pennsauken, NJ 08109		Block: 5906	Lot: 29
Project Owner(s) Name: Merchantville Pennsauken Water Commision		Email: rspafford@mpwc.xom	Phone #: (856) 663-0043 Fax #:
Project Owner(s) Street Address (No P.O. Box Numbers): 6751 Westfield Avenue		City: Pennsauken	State: NJ Zip: 08110
Total Project Area (Acres): 0.849	Total Disturbed Area (Acres): 0.849	Total Soil Restoration Area (Acres):	No. Dwelling or other Units: 0
			Fee $: 1,125.00
Plans Prepared by*: Remington & Vernick Engineers		Email of plan preparer: dennis.yoder@rve.com	Phone #: (856) 795-9595 Fax #:
Street Address: 2059 Springdale Road		City: Cherry HIll	State: NJ Zip: 08003

*(Engineering related items of the Soil Erosion and Sediment Control Plan **MUST** be prepared by or under the direction of and be sealed by a Professional Engineer or Architect licensed in the State of New Jersey, in accordance with NJAC 13:27-6.1 et. seq.)

Agent Responsible During Construction: RVE			Email: flora.marciano@rve.com
Street Address: 2059 Springdale Road			
City: Cherry Hill	State: NJ	Zip: 08003	Phone: (856) 780-0121 Fax #: (856) 429-0121

The applicant hereby certifies that all soil erosion and sediment control measures are designed in accordance with current **Standards for Soil Erosion and Sediment Control In New Jersey** and will be installed in accordance with those Standards and the plan as approved by the Soil Conservation District and agrees as follows:

1. To notify the District in writing at least 48 hours in advance of any land disturbance activity. Failure to provide such notification may result in additional inspection fees.
2. To notify the District upon completion of the Project (Note: No certificate of occupancy can be granted until a report of compliance is issued by the District.
3. To maintain a copy of the certified plan on the project site during construction.
4. To allow District agents to go upon project lands for inspection.
5. That any conveyance of this project or portion thereof prior to its completion will transfer full responsibility for compliance with the certified plan to any subsequent owners.
6. To comply with all terms and conditions of this application and certified plan including payment of all fees prescribed by the district fee schedule hereby incorporated by reference.

The applicant hereby acknowledges that structural measures contained in the Soil Erosion and Sediment Control Plan are reviewed for adequacy to reduce offsite soil erosion and sedimentation and not for adequacy of structural design. The applicant shall retain full responsibility for any damages which may result from any construction activity notwithstanding district certification of the subject soil erosion and sediment control plan. It is understood that approval of the plan submitted with this application shall be valid only for the duration of the initial project approval granted by the municipality. All municipal renewals of this project will require submission and approval by the district. In no case shall the approval extend beyond three- and one-half years at which time resubmission and certification will be required. Soil Erosion and Sediment Control Plan certification is limited to the controls specified in the plan. It is not authorization to engage in the proposed land use unless such use has been previously approved by the municipality or other controlling agency. It is further understood that all documents, site plans, design reports etc. submitted to the district shall be made available to the public (upon request) pursuant to the Open Public Records Act, N.J.S.A. 47:1A-1 et seq.

1. Applicant Certification* Signature: [signature] Date: 7/24/24 Applicant Name (Print): Richard Spafford, P.E.	3. Plan determined complete: Signature of District Official: [signature] Date: 9/15/24
2. Receipt of fee, plan and supporting documents is hereby acknowledged: Signature of District Official: [signature] Date: 8/28/24	4. Plan certified, denied or other actions noted above. Special Remarks: Signature of District Official: [signature] Date: 9/23/24

***If other than project owner, written authorization of owner must be attached.**

SSCC251 AP10 4/19

APPENDIX C

NEW JERSEY STATE WAGE RATES

STATE OF NEW JERSEY
Department of Labor and Workforce Development
Division of Wage and Hour Compliance - Public Contracts Section
PO Box 389
Trenton, NJ 08625-0389

PREVAILING WAGE RATE DETERMINATION

The New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) requires that the Department of Labor and Workforce Development establish and enforce a prevailing wage level for workers engaged in public works in order to safeguard their efficiency and general well being and to protect them as well as their employers from the effects of serious and unfair competition.

Prevailing wage rates are wage and fringe benefit rates based on the collective bargaining agreements established for a particular craft or trade in the locality in which the public work is performed. In New Jersey, these rates vary by county and by the type of work performed.

Applicable prevailing wage rates are those wages and fringe benefits in effect on the date the contract is awarded. All pre-determined rate increases listed at the time the contract is awarded must also be paid, beginning on the dates specified. Rates that have expired will remain in effect until new rates are posted.

Prevailing Wage Rate

The prevailing wage rate for each craft will list the effective date of the rate and the following information:

W = Wage Rate per Hour **B** = Fringe Benefit Rate per Hour* **T** = Total Rate per Hour

* Fringe benefits are an integral part of the prevailing wage rate. Employers not providing such benefits must pay the fringe benefit amount directly to the employee each payday. Employers providing benefits worth less than the fringe benefit amount must pay the balance directly to the employee each payday.

Unless otherwise stated in the Prevailing Wage Rate Determination, the fringe benefit rate for overtime hours remains at the straight time rate.

When the Overtime Notes in the Prevailing Wage Rate Determination state that the overtime rates are "inclusive of benefits," the benefit rate is increased by the same factor as the wage rate (i.e. multiplied by 1.5 for time and one-half, multiplied by 2 for double time, etc.).

Apprentice Rate Schedule

An “apprentice” is an individual who is registered with the United States Department of Labor - Office of Apprenticeship and enrolled in a certified apprenticeship program during the period in which they are working on the public works project.

The apprentice wage rate is a percentage of the journeyman wage rate, unless otherwise indicated. The apprentice benefit rate is the full journeyman benefit rate, unless otherwise indicated.

If there is no apprentice rate schedule listed, the individual must be paid at least the journeyman rate even if that individual is in a certified apprentice program for that trade.

If there is no ratio of apprentices to journeymen listed for a particular craft, then the ratio shall be one (1) apprentice to every four (4) journeymen.

Comments/Notes

For each craft listed there will be comments/notes that cover the definition of the regular workday, shift differentials, overtime, recognized holidays, and any other relevant information.

Public Works Contractor Registration

The Public Works Contractor Registration Act (N.J.S.A. 34:11-56.48, et seq.) requires that **all** contractors, subcontractors, or lower tier subcontractors who are working on or who bid on public works projects register with the Department of Labor and Workforce Development. Applications are available at *www.nj.gov/labor* (click on Wage & Hour and then go to Registration & Permits).

Pursuant to N.J.S.A. 34:11-56.51:

> *No contractor shall bid on any contract for public work as defined in section 2 of P.L.1963, c. 150 (C.34:11-56.26) unless the contractor is registered pursuant to this act. No contractor shall list a subcontractor in a bid proposal for the contract unless the subcontractor is registered pursuant to P.L.1999, c.238 (C.34:11-56.48 et seq.) at the time the bid is made. No contractor or subcontractor, including a subcontractor not listed in the bid proposal, shall engage in the performance of any public work subject to the contract, unless the contractor or subcontractor is registered pursuant to that act*.

Snow Plowing

Snow plowing contracts are <u>not</u> subject to the New Jersey Prevailing Wage Act or the Public Works Contractor Registration Act.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Air Conditioning & Refrigeration - Service and Repair **PREVAILING WAGE RATE**

	03/01/24
Journeyman (Mechanic)	W45.23 B30.03 T75.26

Craft: Air Conditioning & Refrigeration - Service and Repair **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
As Shown	1st Year	2nd Year	3rd Year	4th Year	5th Year	Wage = %	of Jnymn	Wage		
Wage and Bene	40%	50%	60%	70%	80%	Bene = %	of Jnymn	Bene		

Ratio of Apprentices to Journeymen - 1:4

Craft: Air Conditioning & Refrigeration - Service and Repair **COMMENTS/NOTES**

THESE RATES MAY BE USED FOR THE FOLLOWING:
- Service/Repair/Maintenance Work to EXISTING facilities.
- Replacement or Installation of air conditioning and refrigeration equipment when the combined tonnage does not exceed 15 tons for refrigeration, or 25 tons for air conditioning.
- Replacement or Installation of "packaged" or "unitary" rooftop-type units when the combined tonnage of the units does not exceed 75 tons.

NOTE: These rates may NOT be used for any work in new construction (including work on new additions).

The regular workday shall consist of 8 hours, starting between 6:00 AM and 10:00 AM, Monday through Friday.

SHIFT DIFFERENTIALS:
- The second and third shifts shall be paid an additional 15% of the hourly rate.
- All shifts must run for a minimum of 5 consecutive days.

OVERTIME:
Hours worked in excess of 8 per day or before or after the regular workday, that are not shift work, and all hours on Saturday shall be paid at time and one-half the hourly rate, inclusive of benefits. All hours on Sunday and holidays shall be paid at double the hourly rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Boilermaker **PREVAILING WAGE RATE**

	01/12/24
Foreman	W54.11 B47.08 T101.19
General Foreman	W56.11 B48.14 T104.25
Journeyman	W49.11 B45.31 T94.42

Craft: Boilermaker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1000 Hours	65%	70%	75%	80%	85%	90%	95%			
Benefit =	38.33	39.30	40.32	41.31	42.32	43.32	44.30			

Ratio of Apprentices to Journeymen - *

* 1 apprentice will be allowed for the first 5 journeymen, 1 apprentice for the next 10 journeymen and 1 apprentice for each succeeding 20 journeymen up to a maximum of 5 apprentices per contractor on any one job.

Craft: Boilermaker **COMMENTS/NOTES**

HIGH WORK: All apprentices working on the erection, repair, or dismantling of smoke stacks, standpipes, or water towers shall be paid the Journeyman rate.

The regular workday shall consist of 8 hours, between 8:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall work 7? hours and receive 8 hours pay, at a rate equal to the regular hourly rate plus 10%.
- The third shift shall work 7 hours and receive 8 hours pay, at a rate equal to the regular hourly rate plus 20%.
- For "Municipal Water Works" projects only, the following shall apply: Two, four day, 10 hour shifts may be worked at straight time Monday through Thursday. The day shift shall work four days, at 10 hours, for 10 hours pay. The second shift shall work four days, at nine and a half hours, for 10 hours pay, plus 10% the hourly rate for new work and .25 cents on repair work. Friday may be used as a make-up day at straight time, due to weather conditions, hoilday or any other circumstances beyond the employer's control.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays (except Labor Day) shall be paid at double the hourly rate. All hours on Labor Day shall be paid at four times the hourly rate.
- If any other craft employed by the same contractor, or a subcontractor thereof, receives double time in lieu of time and one-half, then the Boilermaker shall receive double time in lieu of time and one-half.
- For "Municipal Water Works" projects only, the following shall apply: Four 10 hour days may be worked Monday through Thursday at straight time. Friday may be used as a make-up day for a day lost to inclement weather, holiday or other conditions beyond the control of the employer. Overtime shall be paid for any hours that exceed 10 hours per day or 40 hours per week.

RECOGNIZED HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Boilermaker - Minor Repairs **PREVAILING WAGE RATE**

	01/12/24
Foreman	W35.88 B17.89 T53.77
General Foreman	W36.38 B17.89 T54.27
Mechanic	W34.38 B17.89 T52.27

Craft: Boilermaker - Minor Repairs **COMMENTS/NOTES**

NOTE: These rates apply to MINOR REPAIR WORK ONLY (repair work in the field for which the contract amount does not exceed $125,000.00), for boilers that do not produce electric or are not used in the heating of petroleum products.

OVERTIME:
Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays (except Labor Day) shall be paid at double the hourly rate. All hours on Labor Day shall be paid at four times the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Washington's Birthday, Good Friday, Memorial Day, July 4th, Labor Day, Presidential Election Day, Thanksgiving Day, day after Thanksgiving, Christmas Day. Saturday holidays observed the preceding Friday, Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Bricklayer, Stone Mason **PREVAILING WAGE RATE**

	05/09/24
Deputy Foreman	W51.60 B37.68 T89.28
Foreman	W56.35 B37.68 T94.03
Journeyman	W48.60 B37.68 T86.28

Craft: Bricklayer, Stone Mason **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 months	40%	50%	55%	60%	65%	70%	75%	80%		
Benefits	5.61	6.88	7.50	8.13	28.95	30.86	32.78	34.67		

Ratio of Apprentices to Journeymen - 1:5

Craft: Bricklayer, Stone Mason **COMMENTS/NOTES**

The regular workday shall consist of 8 hours, between 6:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
- When a 2 shift schedule (including a day shift) is established, the first, or day shift, shall be established on an 8 hour basis. The second shift shall be established on an 8 hour basis, and receive the regular rate plus 10%, inclusive of benefits.
- When a three shift schedule is established, the first shift shall be established on an 8 hour basis, the second shift on a 7.5 hour basis, and the third shift on a 7 hour basis. The first shift shall receive the regular hourly rate, the second shift shall receive the regular rate plus 10%, inclusive of benefits, and the third shift shall receive the regular rate plus 15%, inclusive of benefits.
- When there is no day shift, and a second or third shift is established, it shall be established on an 8 hour basis. The second shift shall receive the regular rate plus 10%, inclusive of benefits, and the third shift shall receive the regular rate plus 15%, inclusive of benefits.
- When an irregular shift must be established, this shift shall receive the regular rate plus 10%, inclusive of benefits.

OVERTIME:
- The first 2 hours in excess of 8 per day, or before or after the regular workday that are not shift work, Monday through Friday, shall be paid at time and one-half the regular rate, inclusive of benefits. Any additional overtime shall be paid at double the regular rate, inclusive of benefits. The first 10 hours on Saturday shall be paid at time and one-half the regular rate, inclusive of benefits. Any additional overtime shall be paid at double the regular rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.
- Saturday may be used as a make-up day for hours lost to inclement weather.
- When Bricklayers/Stone Masons work on Saturday with Laborers, and no other crafts are working on the project for the day, benefits may be paid at straight time. If other crafts are present, the applicable overtime rate for benefits shall be paid.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Carpenter **PREVAILING WAGE RATE**

	05/09/24
Foreman	W64.41 B38.73 T103.14
Journeyman	W56.01 B33.76 T89.77

Craft: Carpenter **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	40%	55%	65%	80%	90%					
Benefit	59.25% of	Appren	tice	Wage Rate	for all	intervals	+ $0.57			

Ratio of Apprentices to Journeymen - 1:3

For Solar installation- all work on solar projects that fall under the jurisdiction of the carpenters, and does not require an electrician, the ratio of Apprentices to Journeymen shall be 1:1.

Craft: Carpenter **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE FOR THOSE APPRENTICES REGISTERED AS OF 5-1-19:

INTERVAL PERIOD AND RATES
Yearly 40% 55% 65% 80%
Benefits 59.25% of apprentice wage rate for all intervals + $0.57

FOREMAN REQUIREMENTS:
- When there are 2 or more Carpenters on a job, 1 shall be designated as a Foreman.
- When there are 21 or more Carpenters on a job, 2 shall be designated as Foremen.

The regular workday shall consist of 8 hours, starting between 6:00 AM and 9:00 AM.

SHIFT DIFFERENTIALS:
- When a 2 shift schedule (including a day shift) is established, the day shift shall be established on an 8 hour basis. The second shift shall be established on an 8 hour basis, and receive the regular rate plus 10%, inclusive of benefits.
- When a three shift schedule is established, the first shift shall be established on an 8 hour basis, the second shift on a 7.5 hour basis, and the third shift on a 7 hour basis. The first shift shall receive the regular hourly rate, the second shift shall receive the regular rate plus 10% and the third shift shall receive the regular rate plus 15%, inclusive of benefits.
- When there is no day shift, and a second or third shift is established, it shall be established on an 8 hour basis. The second shift shall receive the regular rate plus 10% and the third shift shall receive the regular rate plus 15%, inclusive of benefits.
- When an irregular shift must be established, this shift shall receive the regular rate plus 15%, inclusive of benefits.
- All time worked before and after a regularly established shift shall be paid at the applicable overtime rate. When a portion of the regularly established shift works into Saturday, Sunday or a holiday, that time worked shall be paid at the established shift rate.

OVERTIME:

- All hours in excess of 8 per day, or before or after an established shift that are not shift work, and all hours on Saturdays shall be paid at time and one-half the hourly rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the hourly rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday to Thursday, at straight time. Friday may be used as a make-up day for a day lost due to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans' Day may be substituted for the day after Thanksgiving.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Carpenter - Resilient Flooring **PREVAILING WAGE RATE**

	05/01/24
Foreman	W64.41 B38.64 T103.05
Journeyman	W56.01 B33.67 T89.68

Craft: Carpenter - Resilient Flooring **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	40%	55%	65%	80%	90%					
Benefit	59.25% of	Appren	tice	Wage Rate	for all	intervals	+ $0.48			

Ratio of Apprentices to Journeymen - *

* Ratio is 1 apprentice to 2 journeymen. No more than 3 apprentices may be on any 1 project.

Craft: Carpenter - Resilient Flooring **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE FOR THOSE APPRENTICES REGISTERED AS OF 5-1-19:

INTERVAL PERIOD AND RATES
Yearly 40% 55% 65% 80%
Benefits 59.25% of apprentice wage rate for all intervals + $0.48.

FOREMAN REQUIREMENTS:
- On any job where there are 4 or more Carpenters of Resilient Flooring, 1 must be designated a Foreman.

FOR SYNTHETIC TURF INSTALLATION ONLY:
- The rate shall be 90% of the wage and benefit rate.

The regular workday consists of 8 hours, starting between 6:00 AM and 9:00 AM.

SHIFT DIFFERENTIALS:
- When a 2 shift schedule (including a day shift) is established, the day shift, shall be established on an 8 hour basis. The second shift shall be established on an 8 hour basis, and receive the regular wage rate plus 10%.
- When a three shift schedule is established, the first shift shall be established on an 8 hour basis, the second shift on a 7.5 hour basis, and the third shift on a 7 hour basis. The first shift shall receive the regular wage rate, the second shift shall receive the regular wage rate plus 10% and the third shift shall receive the regular wage rate plus 15%.
- When there is no day shift, and a second or third shift is established, it shall be established on an 8 hour basis. The second shift shall receive the regular wage rate plus 10% and the third shift shall receive the regular wage rate plus 15%.
- When an irregular shift must be established, this shift shall receive the regular rate plus 15%, inclusive of benefits.

OVERTIME:
- Hours in excess of 8 per day or 40 per week, or before or after the regular workday, Monday through Friday, shall be paid at time and one-half the wage rate. Saturday may be used as a make-up day, at straight time, up to 8 hours, for hours lost to reasons beyond the control of the employer, up to a total of 40 hours per week; hours in excess of 8 on Saturday shall then be paid at time and one-half the wage rate. If Saturday is not a make-up day, all hours on Saturday shall be paid at

time and one-half the wage rate. All hours on Sundays and holidays shall be paid at double the wage rate.
- Four 10-hour days may be worked, Monday to Thursday, at straight time. Friday may be used as a make-up day for hours lost to reasons beyond the control of the employer. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the wage rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday. Veterans' Day may be substituted for the day after Thanksgiving.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Carpenter-Residential Construction **PREVAILING WAGE RATE**

	05/09/24
Foreman	W54.29 B11.99 T66.28
Journeyman	W47.21 B11.14 T58.35

Craft: Carpenter-Residential Construction **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	40%	55%	65%	80%						
Benefit	12% of	Appren	tice	wage rate	for all	intervals	+ $5.48			

Ratio of Apprentices to Journeymen - 1:3

Craft: Carpenter-Residential Construction **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- When there are 2 or more Carpenters on a job, 1 shall be designated as a Foreman.
- When there are 21 or more Carpenters on a job, 2 shall be designated as Foremen.

The regular workday shall consist of 8 hours, starting between 6:00 AM and 9:00 AM.

RESIDENTIAL CONSTRUCTION:
All residential construction (excluding commercial buildings and institutional housing), no more than four (4) floors in height above grade consisting of those projects involving the construction, alteration, or repair of town houses or row houses, single family homes, mobile homes, multi-family homes, mixed-use buildings that include commercial space on the first floor or below grade, and apartment buildings.

SHIFT DIFFERENTIALS:
- When a 2 shift schedule (including a day shift) is established, the day shift shall be established on an 8 hour basis. The second shift shall be established on an 8 hour basis, and receive the regular rate plus 10%, inclusive of benefits.
- When a three shift schedule is established, the first shift shall be established on an 8 hour basis, the second shift on a 7.5 hour basis, and the third shift on a 7 hour basis. The first shift shall receive the regular hourly rate, the second shift shall receive the regular rate plus 10% and the third shift shall receive the regular rate plus 15%, inclusive of benefits.
- When there is no day shift, and a second or third shift is established, it shall be established on an 8 hour basis. The second shift shall receive the regular rate plus 10% and the third shift shall receive the regular rate plus 15%, inclusive of benefits.
- When an irregular shift must be established, this shift shall receive the regular rate plus 15%, inclusive of benefits.

OVERTIME:
- All hours in excess of 8 per day, or before or after an established shift that are not shift work, and all hours on Saturdays shall be paid at time and one-half the hourly rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the hourly rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday to Thursday, at straight time. Friday may be used as a make-up day for a

day lost due to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans' Day may be substituted for the day after Thanksgiving.

County - CAMDEN

Craft: Cement Mason **PREVAILING WAGE RATE**

See " Bricklayer, Stone Mason" Rates

Craft: Cement Mason **COMMENTS/NOTES**

***See " Bricklayer, Stone Mason" Rates

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Commercial Painter **PREVAILING WAGE RATE**

	05/29/24
Foreman	W48.90 B30.71 T79.61
General Foreman	W53.34 B30.71 T84.05
Journeyman	W44.45 B30.71 T75.16

Craft: Commercial Painter **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	45%	55%	65%	70%	75%	80%	80%		
Benefits	9.40	9.40	11.90	11.90	13.00	13.00	15.90	15.90		

Ratio of Apprentices to Journeymen - 1:4

Craft: Commercial Painter **COMMENTS/NOTES**

* Commercial Painters perform work on all commercial structures such as offices, schools, hotels, shopping malls, restaurants, condominiums, etc.

Spraying, sandblasting, lead abatement work on commercial buildings, work performed above 3 stories or 30 feet in height, or using swing scaffolds requires an additional 10% of the wage rate.

FOREMEN REQUIREMENTS:
- When there are 4 or more Painters on a job, 1 shall be designated a Foreman.
- When there are 15 or more Painters on a job, 1 shall be designated a General Foreman.

The regular workday shall consist of 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall receive an additional 10% of the hourly rate, per hour, and the third shift shall receive an additional 15% of the hourly rate, per hour.

OVERTIME:
- Hours in excess of 8 per day, or before or after the regular workday, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the regular rate. All hours on Sundays and holidays shall be paid at double the regular rate.
- Saturday or Sunday may be used to make up a day lost to inclement weather, at straight time.
- Four 10-hour days may be worked, at straight time, Monday through Friday.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, General Election Day,

Veterans' Day, Thanksgiving Day, Christmas Day.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Diver **PREVAILING WAGE RATE**

	05/01/24
Diver	W59.38 B43.62 T103.00
Tender	W47.50 B43.62 T91.12

Craft: Diver **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1500 hours	70%	75%	80%	85%						
Benefits	31.35	32.41	33.47	34.54						

Ratio of Apprentices to Journeymen - 1:4

Craft: Diver **COMMENTS/NOTES**

NOTE: All dive crews must consist of a Tender, a Diver, and a Standby Diver (Standby Diver is the same rate as a Diver).

- Diver- will perform all Dive related tasks at hand.
- Tender- will provide Tending support to the in water Diver and who may also be designated as a Standby Diver .

Diving in Contaminated Water (including, but not limited to, radioactively contaminated water, sewer effluent combined sanitary and storm sewers, or any environment known to be harmful to those with skin contact): Shall receive an additional 20% of the hourly rate.

OVERTIME:
- The first 2 hours in excess of 8 per day (9th and 10th hours), Monday through Friday, and the first 8 hours on Saturdays shall be paid at time and one-half the hourly rate. Hours in excess of 10 per day, Monday through Friday, hours in excess of 8 per day on Saturdays, and all hours on Sundays and holidays shall be paid at double the hourly rate.
- Employees may work four 10-hour days, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, the first 10 hours on Friday shall be paid at time and one-half the hourly rate. Hours in excess of 10 per day shall be paid at double the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day. Saturday holidays will be observed the preceeding Friday and Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Dockbuilder/Pile Driver **PREVAILING WAGE RATE**

	05/01/24
Foreman	W57.00 B43.62 T100.62
Journeyman	W47.50 B43.62 T91.12

Craft: Dockbuilder/Pile Driver **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1500 hours	40%	50%	65%	80%						
Benefits	25.26	27.39	30.39	33.53						

Ratio of Apprentices to Journeymen - 1:3

Craft: Dockbuilder/Pile Driver **COMMENTS/NOTES**

NOTE: The following shall be required for type of work indicated-
- There shall be one foreman and four journeymen on all land pile driving rigs. As part of the crew, one may be an apprentice.
- There shall be one foreman and two journeymen on self-contained hydraulic driving rigs. As part of the crew, one may be an apprentice.
- There shall be one foreman and two journeymen when driving sheeting with an excavator. As part of the crew, one may be an apprentice.
- When utilizing a drill rig to install Auger cast piles there shall be one foreman and two journeymen. As part of the crew , one may be an apprentice.
- There shall be one journeyman on drilled or bored soldier piles.
- There shall be not less than one journeyman per rig on all drilled shaft and caissons.
- There shall be not less than one journeyman per rig on all earth retention tie-back and anchors.

Creosote Handling:
May 1st to Sept. 30th: + $0.50 above hourly rate
Oct. 1st to April 30th: + $0.25 above hourly rate

Harzardous Material Work:
-On hazardous material work on a state or federally designated hazardous work site where the worker is required to wear Level A, B or C personal protection, the worker shall receive an additional 20% of the hourly rate, per hour.
- A Dockbuilder/Pile Driver working on a hazardous waste removal project, or site requiring hazardous waste related certification, but who is not working in a zone requiring level A, B or C personal protection, shall receive the hourly rate plus an additional $1.00 per hour. This type of work does not include the handling of creosote or CCA materials; coated materials such as bitumastic, or galvanized; painted materials or any products designed to be used in the industry.

FOREMAN REQUIREMENTS:
- When there are 3 or more Dockbuilders/Pile Drivers on a job, 1 shall be designated as a Foreman.

SHIFT WORK:

- Shift work pertains to both land and water work.
- When a 2 shift schedule (including a day shift) is established, the first shift shall start between 5:00 am and 8:00 am and work for 7 and one-half hours and receive 8 hours pay. The second shift shall start when the first shift ends and shall work for 7 and one-half hours and receive 8 hours pay.
- When a three shift schedule is established, all shifts shall work 7 and one-half hours and receive 8 hours pay.
- When there is no day shift, and a second or third shift is established, a worker shall be paid at time and one-half of the hourly rate.

OVERTIME:
- The first 2 hours in excess of 8 per day (9th and 10th hours), Monday through Friday, and the first 8 hours on Saturdays shall be paid at time and one-half the hourly rate. Hours in excess of 10 per day, Monday through Friday, hours in excess of 8 per day on Saturdays, and all hours on Sundays and holidays shall be paid at double the hourly rate.
- Employees may work four 10-hour days, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, the first 10 hours on Friday shall be paid at time and one-half the hourly rate. Hours in excess of 10 per day shall be paid at double the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day. Saturday holidays will be observed the preceeding Friday and Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Drywall Finisher **PREVAILING WAGE RATE**

	05/29/24
Foreman	W47.75 B31.11 T78.86
General Foreman	W49.92 B31.11 T81.03
Journeyman	W43.41 B31.11 T74.52

Craft: Drywall Finisher **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
6 Months	40%	50%		60%	70%		80%	90%		
Benefits	Intervals	1 to 2 =	11.90	Intervals	3 to 4 =	15.03	Intervals	5 to 6 =	18.84	

Ratio of Apprentices to Journeymen - 1:4

Craft: Drywall Finisher **COMMENTS/NOTES**

The regular workday shall consist of 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall receive an additional 10% of the hourly rate, per hour, and the third shift shall receive an additional 15% of the hourly rate, per hour.
- When 3 shifts are worked, the second shift shall receive 8 hours pay for 7.5 hours of work, and the third shift shall receive 8 hours pay for 7 hours of work.
- Shift work must run for a minimum of 5 consecutive workdays.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.
- Saturday or Sunday may be used to make up a day lost to inclement weather, at straight time.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Saturday holiday observed the preceding Friday. Sunday holiday observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Electrician **PREVAILING WAGE RATE**

	10/03/24
Asst. General Foreman	W66.06 B58.03 T124.09
Foreman	W61.66 B54.61 T116.27
General Foreman	W71.57 B62.33 T133.90
Journeyman, Cable Splicer	W55.05 B49.47 T104.52
Lead Foreman	W63.31 B55.90 T119.21
Working Foreman, Welder, Crane Operator (all types)	W57.80 B51.61 T109.41

Craft: Electrician **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
Yearly	16.30	20.70	23.40	27.63	31.87					
Benefits	8.14	9.39	10.15	11.36	12.56					

Ratio of Apprentices to Journeymen - 2:3

Craft: Electrician **COMMENTS/NOTES**

THESE RATES ALSO APPLY TO THE FOLLOWING:
- All fire and burglar alarm work.
- All fiber optic work.
- Teledata work in new construction (including additions).
- Teledata work involving 16 or more instruments or voice/data lines.
- All camera installations.

Height Work: 40 feet above ground/floor: +10% of the wage and benefit amount.

FOREMAN REQUIREMENTS (number of Electricians on site):
(2 to 10) - a Working Foreman; (11 to 22) - a Foreman; (23 to 44) - a Lead Foreman; (35 to 48) - an Assistant General Foreman; (49 or more) - a General Foreman.

The regular workday consists of 8 hours, between 7:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of 5 consecutive workdays
- 2nd Shift (4:30 PM to 12:30 AM): 8 hrs. pay for 7.5 hrs. work + an additional 10% of the wage rate, inclusive of benefits.
- 3rd Shift (12:30 AM to 8:00 AM): 8 hrs. pay for 7 hrs. work + an additional 15% of the wage rate, inclusive of benefits.

OVERTIME:
The first 4 hours in excess of 8 per day, or before or after the regular workday, Monday through Friday, and the first 8 hours on Saturdays, shall be paid at time and one-half the regular rate, inclusive of benefits. Hours in excess of 12 per day, Monday through Friday, in excess of 8 on Saturdays, and all hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Electrician - Teledata (15 Voice/Data Lines & Less) **PREVAILING WAGE RATE**

	09/18/24
Master Technician/Gen. Foreman (31+ Workers on Job)	W52.80 B39.65 T92.45
Senior Technician/Lead Foreman (21-30 Workers on Job)	W48.25 B38.15 T86.40
Technician A/Foreman (11-20 Workers on Job)	W46.14 B37.46 T83.60
Technician B/Working Foreman (4-10 Workers on Job)	W44.89 B36.05 T80.94
Technician C/Journeyman (1-3 Workers on Job)	W41.00 B33.77 T74.77

Craft: Electrician - Teledata (15 Voice/Data Lines & Less) **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
6 Months	17.26	17.26	20.54	20.54	25.48	25.48	30.02	30.02		
Benefits	9.85	9.85	10.82	10.82	12.77	12.77	15.12	15.12		

Ratio of Apprentices to Journeymen - 2:3

Craft: Electrician - Teledata (15 Voice/Data Lines & Less) **COMMENTS/NOTES**

NOTES: These rates are for service, maintenance, moves and/or changes affecting 15 voice/data lines or less. These rates may NOT be used for any new construction or fiber optic work.

FOREMAN REQUIREMENTS:
The number of workers on the jobsite is the determining factor for which Foreman category applies.

HIGH WORK: Any work performed 40 feet above ground or floor: +10% of the wage and benefit amount.

SHIFT DIFFERENTIAL:
- 2nd Shift (4:30 PM to 12:30 AM) - 8 hrs. pay for 7.5 hrs. work + an additional 10% of the wage rate, inclusive of benefits.
- 3rd Shift (12:30 AM to 8:00 AM) - 8 hrs. pay for 7 hrs. work + an additional 15% of the wage rate, inclusive of benefits.

OVERTIME:
Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Electrician - Teledata (16 Instruments & More) **PREVAILING WAGE RATE**

See "Electrician" Rates

Craft: Electrician - Teledata (16 Instruments & More) **COMMENTS/NOTES**

See ELECTRICIAN Rates

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Electrician- Outside Commercial **PREVAILING WAGE RATE**

	10/03/24
Assistant General Foreman	W66.06 B57.98 T124.04
Foreman	W61.66 B54.53 T116.19
General Foreman	W71.57 B62.32 T133.89
Groundhand, Truck Driver, Conduit Installer (1 year or more experience)	W27.53 B27.74 T55.27
Groundhand, Truck Driver, Conduit Installer (2 years or more experience)	W38.54 B36.38 T74.92
Groundhand, Truck Driver, Conduit Installer (3 years or more experience)	W46.79 B42.27 T89.06
Groundhand, Truck Driver, Conduit Installer (less than1 year exp.)	W22.02 B1.54 T23.56
Journeyman Lineman	W55.05 B49.33 T104.38
Lead Foreman	W63.31 B55.82 T119.13
Working Foreman	W57.80 B51.49 T109.29

Craft: Electrician- Outside Commercial **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	25.52	27.63	29.75	31.87	33.99	36.11	38.22			
Benefits	10.55	11.17	11.77	12.40	13.01	13.63	14.25			

Craft: Electrician- Outside Commercial **COMMENTS/NOTES**

* FOR UTILITY WORK PLEASE SEE STATEWIDE RATES

FOREMAN REQUIREMENTS (number of Electricians on site):
(1 to10)- one Working Foreman.
(11 to 20)- one Working Foreman and one Foreman.
(21 to 30)- one Working Foreman, one Foreman and one Lead Foreman.
(31 to 40) - one Working Foreman, two (2) Foremen and one Lead Foreman.
(41 to 50)- one Working Foreman, four (4) Foremen, one Assistant General Foreman (runs 5 foremen), and one General Foreman.
(51 to 60)- one Working Foreman, five (5) Foremen, one Assistant General Foreman (runs 5 foremen), and one General Foreman
(runs one foreman).
(61 to 70)- one Working Foreman, six (6) Foremen, one Assistant General Foreman (runs 5 foremen), and one General Foreman
(runs two foremen).
(71 to 80)- one Working Foreman, seven (7) Foremen, two (2) Assistant General Foremen and one General Foreman.
(81 to 90)- one Working Foreman, eight (8) Foremen, two (2) Assistant General Foremen, and one General Foreman.
(91 to 100)- one Working Foreman, nine (9) Foremen, two (2) Assistant General Foremen and one General Foreman.

The regular workday consists of 8 hours, between 7:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
Shift work must run for a minimum of 5 consecutive workdays.
2nd Shift (4:30 PM to 12:30 AM): 8 hrs. pay for 7.5 hrs. work + an additional 10% of the wage rate, inclusive of benefits.
3rd Shift (12:30 AM to 8:00 AM): 8 hrs. pay for 7 hrs. work + an additional 15% of the wage rate, inclusive of benefits.

OVERTIME:
All hours in excess of 8 per day, Monday through Friday, that are not shift work, and all hours on Saturday shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sundays and Holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS:
New Year's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Electrician-Utility Work (North) **PREVAILING WAGE RATE**

Rates are located in the "Statewide" rate package

Craft: Electrician-Utility Work (North) **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
* 6 Months	60%	65%	70%	75%	80%	85%	90%			
Benefits	69% of	Appren	tice	Wage	Rate	for all	intervals			

Craft: Electrician-Utility Work (North) **COMMENTS/NOTES**

Electrician-Utility Work (North) rates are located in the "Statewide" rate package.

* The apprentice wage rate is paid at the percentage of the Journeyman Lineman wage rate located in the "Statewide" rate package.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Electrician-Utility Work (South) **PREVAILING WAGE RATE**

Rates are located in the "Statewide" rate package

Craft: Electrician-Utility Work (South) **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	33.69	36.50	39.31	42.11	44.92	47.73	50.54			
Benefits	29.97	31.72	33.46	35.21	36.96	38.71	40.45			

Craft: Electrician-Utility Work (South) **COMMENTS/NOTES**

Electrician-Utility Work (South) rates are located in the "Statewide" rate package.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Elevator Constructor **PREVAILING WAGE RATE**

	01/01/25
Helper-Over 5 Years	W50.30 B44.05 T94.35
Helper-Under 5 Years	W50.30 B43.05 T93.35
Mechanic (Journeyman) over 5 years	W71.85 B45.78 T117.63
Mechanic (Journeyman) under 5 years	W71.85 B44.37 T116.22
Mechanic in Charge (Foreman) over 5 years	W80.83 B46.50 T127.33
Mechanic in Charge (Foreman) under 5 years	W80.83 B44.88 T125.71
Probationary Helper (1st 6 months)	W35.93 B42.19 T78.12

Craft: Elevator Constructor **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
Yearly	55%	65%	70%	80%						
Benefits	full	journeyman	benefit	rate for	all	intervals				

Ratio of Apprentices to Journeymen - *

* Total number of helpers and apprentices shall not exceed the number of mechanics on the job , except where 2 teams are working, 1 additional helper or apprentice may be employed for first 2 teams and an extra helper or apprentice for each additional 3 teams. Further, the employer may use as many helpers or apprentices as needed, under the direction of a mechanic in wrecking old plants, handling and hoisting material, and on foundation work. When replacing cables on existing elevators, employer may use 2 helpers or apprentices to 1 mechanic.

Craft: Elevator Constructor **COMMENTS/NOTES**

SHIFT DIFFERENTIALS:
- 2nd Shift (4:30 PM to 12:30 AM) shall be established on the basis of 7.5 hours of work for 8 hours of pay, plus an additional 10% per hour.
- 3rd Shift (12:30 AM to 8:00 AM) shall be established on the basis of 7 hours of work for 8 hours of pay, plus an additional 15% per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays, Sundays, and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday to Thursday or Tuesday to Friday, at straight time. When working a 4-10 hour day schedule, all hours worked on a day other than the days established for the 4-10 hour schedule shall be paid at double the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day and day after, Christmas Day. Saturday holidays observed the preceding Friday, Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Glazier **PREVAILING WAGE RATE**

	05/09/24
Foreman	W52.00 B37.50 T89.50
Journeyman	W48.00 B37.50 T85.50

Craft: Glazier **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	22.56	24.00	26.88	30.24						
Benefits	19.79	22.54	23.99	26.61						

Ratio of Apprentices to Journeymen - 1:3

Craft: Glazier **COMMENTS/NOTES**

HIGH WORK (30 feet above ground /floor or using a swing stage): +$1.00/hr

FOREMAN REQUIREMENT:
- When 4 or more Glaziers are working on a job that runs for 10 days or more, 1 shall be designated a Foreman.

The regular workday shall be 8 hours, between 6:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
- Second and Third shift shall receive the regular hourly rate, plus 15% per hour.

OVERTIME:
- The first 2 hours in excess of 8 per day (9th and 10th hours), or outside the regular workday, Monday through Friday, that are not shift work, and the first 8 hours on Saturdays shall be paid at time and one-half the regular rate. All other daily overtime, and all hours on Sundays and holidays shall be paid at double the regular rate.
- Four 10-hour days may be worked at straight time, Monday through Friday. The 11th and 12th hours on the 4 days worked, and the first 12 hours on the fifth day shall be paid at time and one-half the regular rate. All other daily overtime, and all hours on Saturdays, Sundays, and holidays shall be paid at double the regular rate.
- Benefits on overtime hours are as follows:
  Time and one-half = $46.36/hr.
  Double time = $55.22/hr.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Thanksgiving Day, Christmas Day.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Heat & Frost Insulator **PREVAILING WAGE RATE**

	05/01/24
Foreman (11-20 workers)	W65.30 B46.03 T111.33
Foreman (1-5 workers)	W62.34 B46.03 T108.37
Foreman (21-49 workers)	W68.27 B46.03 T114.30
Foreman (50+ workers)	W71.25 B46.03 T117.28
Foreman (6-10 workers)	W63.53 B46.03 T109.56
Journeyman	W59.37 B46.03 T105.40

Craft: Heat & Frost Insulator **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
1000 Hours	40%	45%	48%	50%	55%	60%	65%	70%	75%	80%
Benefits	35.54	35.54	Intervals	3 to 10 =	39.79					

Ratio of Apprentices to Journeymen - 1:4

Craft: Heat & Frost Insulator **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- Foremen shall be designated based upon the number of Heat & Frost Insulators on the job, with the rates as shown above.
- If there is only 1 Heat & Frost Insulator on the job, he or she must be designated a Foreman.

The regular workday shall be 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of 3 consecutive workdays, with a minimum of 2 consecutive shifts each day.
- 2nd Shift shall be between the hours of 4:00 PM and 12:00 AM.
- 3rd Shift shall be between the hours of 12:00 AM and 8:00 AM.
- All shift work shall be paid an additional 15% of the regular rate, inclusive of benefits.

OVERTIME:
- The 2 hours immediately before or after the regular workday, and the first 10 hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits. All hours in excess of 10 per day, Monday through Saturday, and all hours on Sundays and holidays (except Labor Day), shall be paid at double the regular rate, inclusive of benefits. All hours on Labor Day shall be paid at triple the regular rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Heat & Frost Insulator - Asbestos Worker **PREVAILING WAGE RATE**

	05/01/24
Material Handler - 1st Level	W32.62 B23.87 T56.49
Material Handler - 2nd Level	W47.46 B23.77 T71.23
Mechanic (Journeyman)	W59.37 B46.03 T105.40

Craft: Heat & Frost Insulator - Asbestos Worker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	Heat &	Frost	Insulator						

Craft: Heat & Frost Insulator - Asbestos Worker **COMMENTS/NOTES**

NOTE: These rates apply ONLY to the REMOVAL of insulation containing asbestos from mechanical systems, including containment erection and demolition, and the placing of material in appropriate containers.

JOB TITLES:
- Mechanic: 8,000 hours or more of asbestos removal experience
- Material Handler - 2nd Level: 3,000 hours or more (up to 8,000 hours) of asbestos removal experience
- Material Handler - 1st Level: up to 3,000 hours of asbestos removal experience

RATIOS:
- The first worker on the project must be a Mechanic.
- Ratio of Material Handlers to Mechanics is 5:1 (5 Handlers to 1 Mechanic), with a minimum of two of the Handlers being 2nd Level Handlers.

SHIFT DIFFERENTIALS:
- 2nd Shift shall work 7.5 hours and receive 8 hours pay, plus $0.25 per hour.
- 3rd Shift shall work 7 hours and receive 8 hours pay, plus $0.50 per hour.

OVERTIME:
- Hours in excess of 40 per week, and all hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits.
- All hours on Sundays and holidays (except Labor Day) shall be paid at double the regular rate, inclusive of benefits.
- All hours on Labor Day shall be paid at triple the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Industrial Painter- Bridges **PREVAILING WAGE RATE**

	02/07/25	02/01/26
Foreman	W64.80 B37.40 T102.20	W0.00 B0.00 T104.20
General Foreman	W67.30 B37.40 T104.70	W0.00 B0.00 T106.70
Journeyman	W59.80 B37.40 T97.20	W0.00 B0.00 T99.20

Craft: Industrial Painter- Bridges **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	50%	70%	90%							
Benefits	14.62	21.61	28.11							

Ratio of Apprentices to Journeymen - 1:3

Craft: Industrial Painter- Bridges **COMMENTS/NOTES**

* Industrial Painters perform work on all industrial structures, such as bridges.

These rates apply to: All bridges that span waterways, roadways, railways and canyons. All tunnels, overpasses, viaducts and all appurtenances.

FOREMEN REQUIREMENTS:
- When there are 4 or more Painters on a job, 1 shall be designated a Foreman.
- When there are 15 or more Painters on a job, 1 shall be designated a General Foreman.

The regular workday shall consist of 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall receive an additional 10% of the hourly rate, per hour, and the third shift shall receive an additional 15% of the hourly rate, per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays and Sundays shall be paid at time and one-half the regular rate. All hours on holidays shall be paid at double the regular rate, except Veterans Day, which shall be paid at time and one-half the regular rate.
- During a regular work week schedule, Saturday may be used as a make-up day lost to inclement weather, paid at the regular rate.
- Four 10-hour days may be worked, at the regular rate, Monday through Thursday. When the four 10-hour day schedule is used, the 11th and 12th hours shall be paid at time and one-half the regular rate. After the 12th hour, a worker shall be paid at double the regular rate. Friday may be used as a make-up day lost to inclement weather, paid at the regular rate.

County - CAMDEN

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Saturday holiday observed the preceding Friday. Sunday holiday observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Industrial Painter- Structural Steel **PREVAILING WAGE RATE**

	02/07/25	02/01/26
Foreman	W53.54 B35.05 T88.59	W0.00 B0.00 T90.59
General Foreman	W56.04 B35.05 T91.09	W0.00 B0.00 T93.09
Journeyman	W48.54 B35.05 T83.59	W0.00 B0.00 T85.59

Craft: Industrial Painter- Structural Steel **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	INDUST	RIAL	PAINTER	BRIDGES					

Ratio of Apprentices to Journeymen - 1:3

Craft: Industrial Painter- Structural Steel **COMMENTS/NOTES**

* Industrial Painters perform work on all industrial structures, such as water tanks, waste water facilitites, refineries, any structural steel work, etc.

These rates apply to: All work in power plants (any aspect). On steeples, on dams, on hangers, transformers, substations, on all open steel, in refineries, tank farms, water/sewerage treatment facilities and on pipelines.

FOREMEN REQUIREMENTS:
- When there are 4 or more Painters on a job, 1 shall be designated a Foreman.
- When there are 15 or more Painters on a job, 1 shall be designated a General Foreman.

The regular workday shall consist of 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall receive an additional 10% of the hourly rate, per hour, and the third shift shall receive an additional 15% of the hourly rate, per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays and Sundays shall be paid at time and one-half the regular rate. All hours on holidays shall be paid at double the regular rate, except for Veterans Day, which shall be paid at time and one-half the regular rate.
- During the regular work week schedule, Saturday may be used to make-up a day lost to inclement weather, paid at the regular rate.
- Four 10-hour days may be worked, at the regular rate, Monday through Thursday. When the four 10-hour day schedule is used, the 11th and 12th hours shall be paid at time and one-half the regular rate. After the 12th hour, a worker shall be paid at double the regular rate. Friday may be used as a make-up day lost to inclement weather, paid at the regular rate.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Saturday holiday observed the preceding Friday. Sunday holiday observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Industrial Painter- Water Tanks **PREVAILING WAGE RATE**

	02/07/25	02/01/26
Foreman	W54.59 B34.70 T89.29	W0.00 B0.00 T91.29
General Foreman	W57.09 B34.70 T91.79	W0.00 B0.00 T93.79
Journeyman	W49.59 B34.70 T84.29	W0.00 B0.00 T86.29

Craft: Industrial Painter- Water Tanks **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	50%	70%	90%							
Benefits	14.62	21.61	28.11							

Ratio of Apprentices to Journeymen - 1:3

Craft: Industrial Painter- Water Tanks **COMMENTS/NOTES**

* Industrial Painters perform work on all industrial structures, such as water tanks, waste water facilitites, refineries, any structural steel work, etc.

These rates apply to: All new and repaint water tanks (interior and exterior).

FOREMEN REQUIREMENTS:
- When there are 4 or more Painters on a job, 1 shall be designated a Foreman.
- When there are 15 or more Painters on a job, 1 shall be designated a General Foreman.

The regular workday shall consist of 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall receive an additional 10% of the hourly rate, per hour, and the third shift shall receive an additional 15% of the hourly rate, per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays and Sundays shall be paid at time and one-half the regular rate. All hours on holidays shall be paid at double the regular rate, except Veterans Day, which shall be paid at time and one-half the regular rate.
- During a regular work week schedule, Saturday may be used to make-up a day lost to inclement weather, paid at the regular rate.
- Four 10-hour days may be worked, at the regular rate, Monday through Thursday. When the four 10-hour day schedule is used, the 11th and 12th hours shall be paid at time and one-half the regular rate. After the 12th hour, a worker shall be paid at double the regular rate. Friday may be used as a make-up day lost to inclement weather, paid at the regular rate.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Saturday holiday observed the preceding Friday. Sunday holiday observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Ironworker **PREVAILING WAGE RATE**

	07/12/24
Foreman- Fence and Guardrail	W55.91 B37.94 T93.85
Foreman-Rod/Mesh	W61.23 B38.72 T99.95
Foreman-Structural	W62.38 B38.72 T101.10
Journeyman- Fence and Guardrail	W51.77 B37.94 T89.71
Journeyman-Rod/Mesh	W53.24 B38.72 T91.96
Journeyman-Structural	W54.24 B38.72 T92.96

Craft: Ironworker **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
Yearly	66%	79%	88%							

Ratio of Apprentices to Journeymen - *

* On all work EXCEPT Ornamental Iron and Bridge Cable Spinning Work 1:4; On Ornamental Iron and Bridge Cable Spinning Work 1:1.

Craft: Ironworker **COMMENTS/NOTES**

ROD/MESH (REINFORCING): All work performed in connection with bending, burning, cutting, field fabrication, handling, hoisting, placing, racking, sorting, tying and welding of all materials, including composites used in reinforced concrete construction, all realigning of reinforcing steel and wire mesh and the placement of reinforcing dowels.
The installation, fabrication and distribution of all materials associated with post tensioning and pre-stressing procedures on reinforced concrete jobs.
All prefabricated mates, caissons, columns, beams and walls.
The installation of reinforcing dowels into pre-drilled holes by any means necessary, including epoxy, glue, compounds or tying.
STRUCTURAL: All work performed in connection with bending, burning, cutting, field fabrication, handling, hoisting, placing, racking, sorting, tying and welding of all materials, including composites and mass timbers used in structural frame construction, and realigning of structural framing members.
The installation, fabrication and distribution of all materials associated with structural framework, regardless of material composition, including mass timbers.

All prefabricated columns, beams and walls.
When precast, prestressed or reinforced concrete structural members (beams, columns, girders, slabs, etc.) are used in construction of bridges, buildings and other structures, and power equipment such as cranes, derricks, jacks and/or rigging used, the work of loading, unloading, moving, and placing to complete erection.
Solar canopy erection, ground mounted installation and erection of photovoltaic array assemblies.
Unitized curtain wall systems, including erection and rigging of such, regardless of material composition.
Pre-engineered metal building systems.
Steel decking and siding for building structures and canopy systems.
Offshore wind erection, fabrication, and rigging of all related components.
FENCE AND GUARDRAIL: All work performed in connection with bending, burning, cutting, field fabrication, handling, hoisting, placing, racking, digging and anchoring, sorting, tying, welding and installation of all materials, including composites, security style fencing, regardless of materials used.
Installation, fabrication and distribution of all materials associated with Fence and Guardrail work scope, regardless of material composition.
All prefabricated fencing, permanent, temporary or otherwise.

Note: For work on hazardous waste sites, workers shall receive an additional $3.00 per hour.

The regular workday shall consist of 8 hours between 6:00 AM and 5:00 PM.

SHIFT DIFFERENTIALS:
- Second shift shall receive an additional 10% per hour.
- Third shift shall receive an additional 15% per hour.
- An irregular shift (shift starting after 6:00 PM) shall receive an additional 15% per hour.

OVERTIME:
- Time and one-half the wage rate for hours in excess of 8 per day, or before or after the regular workday, Monday through Friday, and for all hours on Saturdays. Double the wage rate for all hours on Sundays and holidays.
- Employees may work four 10-hour days, Monday to Thursday, at straight time. Friday may be used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours worked on Friday shall be paid at time and one-half the wage rate.
- Benefits on overtime hours shall be paid at the following rates:
  For Rod/Mesh and Structural-
    When wages are time and one-half, benefits = $44.58.
    When wages are double, benefits = $50.44.
  For Fence and Guardrail-
    When wages are time and one-half, benefits = $43.41.
    When wages are double, benefits = $48.88.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, General and Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Laborer - Asbestos & Hazardous Waste Removal **PREVAILING WAGE RATE**

	08/21/24
Foreman	W45.88 B26.21 T72.09
Journeyman (Handler)	W40.78 B26.21 T66.99

Craft: Laborer - Asbestos & Hazardous Waste Removal **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	24.47	28.55	32.62	36.70						
Benefits	22.31	for	all	intervals						

Ratio of Apprentices to Journeymen - *

* Ratio of apprentices to journeymen shall not be more than one apprentice for the first journeyman and no more than one (1) apprentice for each additional three (3) journeymen.

Craft: Laborer - Asbestos & Hazardous Waste Removal **COMMENTS/NOTES**

NOTE: These rates apply to work in connection with Asbestos, Radiation, Hazardous Waste, Lead, Chemical, Biological, Mold Remediation and Abatement.

The regular workday shall be 8 hours.

OVERTIME:
- Hours in excess of 8 per day, Monday through Saturday, and all hours on Sunday and holidays shall be paid at time and one-half the regular rate.
- Benefits on ALL overtime hours shall be paid at straight time.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Easter, Memorial Day, July 4th, Labor Day, Veterans Day, Thanksgiving Day, Christmas Day. (Holidays start at 12:00 am).

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Laborer - Building **PREVAILING WAGE RATE**

	08/28/24
Class A Journeyman	W39.25 B33.17 T72.42
Class B Journeyman	W38.25 B33.17 T71.42
Class C Journeyman	W32.51 B33.17 T65.68
Foreman	W44.16 B33.17 T77.33
General Foreman	W49.06 B33.17 T82.23

Craft: Laborer - Building **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
6 Months	60%	70%	80%	90%	of Class B	wage rate				
Benefit	29.92	29.92	29.92	29.92						

Ratio of Apprentices to Journeymen - *

* Ratio of apprentices to journeymen shall not be more than one apprentice for the first journeyman and no more than one (1) apprentice for each additional three (3) journeymen.

Craft: Laborer - Building **COMMENTS/NOTES**

CLASS A: Specialist laborer including mason tender or concrete pour crew; scaffold builder (scaffolds up to 14 feet in height); operator of forklifts, Bobcats (or equivalent machinery), jack hammers, tampers, motorized tampers and compactors, vibrators, street cleaning machines, hydro demolition equipment, riding motor buggies, conveyors, burners; and nozzlemen on gunite work.
CLASS B: Basic laborer - includes all laborer work not listed in Class A or Class C.
CLASS C: Janitorial-type light clean-up work associated with the TURNOVER of a project, or part of a project, to the owner. All other clean-up work is Class B.

The regular workday shall be 8 hours between 6:00 AM and 6:00 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of 5 consecutive workdays.
- When a 2-shift schedule is worked, including a day shift, both shifts shall be established on the basis of 8 hours pay for 8 hours worked. The second shift shall receive the regular rate plus an additional 10%.
- When a 3-shift schedule is worked, the day shift shall be established on the basis of 8 hours pay for 8 hours worked, the second shift shall be established on the basis of 8 hours pay for 7.5 hours worked, and the third shift shall be established

on the basis of 8 hours pay for 7 hours worked. The day shift shall receive the regular rate, the second shift shall receive the regular rate plus an additional 10%, and the third shift shall receive the regular rate plus an additional 15%.
- When a second or third shift is worked with no day shift, the second or third shift shall be established on the basis of 8 hours pay for 8 hours worked. The second shift shall receive the regular rate plus an additional 10%, and the third shift shall receive the regular rate plus an additional 15%.
- When an irregular shift must be established this shift shall receive the regular rate plus an additional 10%.

OVERTIME:
- Hours in excess of 8 per day, or outside the regular workday that are not shift work, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the regular rate. Saturday may be used as a make-up day (paid at straight time) for a day lost to inclement weather, or for a holiday that is observed during the work week, Monday through Friday. All hours on Sundays and holidays shall be paid at double the regular rate.
- Four 10-hour days may be worked Monday to Thursday, at straight time, with Friday used a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the regular rate.
- Benefits on ALL overtime hours shall be paid at time and one-half.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Laborer - Heavy & General **PREVAILING WAGE RATE**

Rates are located in the
"Statewide" rate package

Craft: Laborer - Heavy & General **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1000 Hours	60%	70%	80%	90%						
Benefit	25.08	for	all	intervals						

Ratio of Apprentices to Journeymen - *

* No more than 1 apprentice for the first journeyman and no more than 1 apprentice for each additional 3 journeymen.

As of 3-1-25, benefits shall be 26.13.
As of 3-1-26, benefits shall be 27.13.

Craft: Laborer - Heavy & General **COMMENTS/NOTES**

Heavy & General Laborer rates are located in the "Statewide" rate package.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Laborer-Residential and Modular Construction **PREVAILING WAGE RATE**

	04/01/23
* Skilled Tradesman (only applies to Modular Construction)	W27.90 B5.45 T33.35
Foreman (person directing crew, regardless of his skill classification)	W31.90 B5.45 T37.35
Laborer (for single family and stand-alone duplex owned by single owner)	W17.85 B2.95 T20.80
Residential and Modular Construction Laborer	W23.90 B5.45 T29.35

Craft: Laborer-Residential and Modular Construction **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
As shown	800 hours	600 hours	600 hours							
wage & benefits	70%	80%	90%							

Ratio of Apprentices to Journeymen-

One (1) apprentice shall be allowed for the first journeyman on site and no more than one (1) additional apprentice for each additional three (3) journeymen on site.

Craft: Laborer-Residential and Modular Construction **COMMENTS/NOTES**

* SKILLED TRADESMAN-
any worker doing work not typically done by a Building Laborer. Some examples are installing interior doors, sheet rock, hooking up appliances, installing light fixtures, installing railing systems, etc. Please note where local building codes require that certain work be performed under the supervision of a licensed tradesman (i.e. Plumber, Electrician, etc.) Laborers shall work under such supervision.

RESIDENTIAL CONSTRUCTION- All residential construction (not commercial), single-family, stand-alone duplex houses, townhouses and multi-family buildings of not more than four (4) floors. Each housing unit must be fully and independently functional; each housing unit must have its own kitchen and bathroom. The definition includes all incidental items such as site work, parking areas, utilities, streets and sidewalks. Please note the construction must be Residential in nature. A First Floor at or below grade may contain commercial space not to exceed 50% square footage of the floor; at least 50% of the First Floor must contain living accommodations or related nonresidential uses (e.g. laundry space, recreation/hobby rooms, and/or corridor space). Basement stories below grade used for storage, parking, mechanical systems/equipment, etc., are considered basement stories which are not used in determining the building's height. An attic is an unfinished space located immediately below the roof. Such space is not used in determining a building's height even if used for storage purposes. In addition, barracks and dormitories are not considered residential projects.

MODULAR RESIDENTIAL CONSTRUCTION- all aspects of modular residential construction (not commercial) at the site of installation of structures of no more than four (4) stories, including all excavation and site preparation, footings and

foundation systems whether poured on-site or prefabricated, all underground waterproofing, underground utilities, concrete slabs, sidewalks, driveways, paving, hardscape and landscaping. Please note the construction must be Residential as defined above. All work performed by the Set Crew (the crew of workers who set the modular boxes on the foundation), including the rigging, setting, attaching and assembly of all modules and structural members, preparation of the foundation to accept modules, such as sill plates, connection of all in-module and under-module connections including, but not limited to, plumbing, electrical, HVAC, fire suppression, CATS, telephone, television/internet, and fiber optic, the building or installation of any porches or decks regardless of material or method of construction, the on-site installation of, or completion of any roof system, doors, windows and fenestrations, including flashing, gutter and soffit systems, waterproofing, insulation and interior and exterior trim work, and painting. Please note that modular construction does not include on-site stick built construction, tip up construction or panel built construction.

The regular workday shall be 8 hours between 6:00 AM and 6:00 PM.

OVERTIME:
Hours worked in excess of 8 per day/40 per week, Monday through Saturday, and all hours worked on Sunday and holidays shall be paid at time and one-half the hourly rate.

RECOGNIZED HOILDAYS:
New Year's Day, Martin Luther King Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Millwright **PREVAILING WAGE RATE**

	05/01/24
Foreman	W66.04 B39.75 T105.79
Journeyman	W57.43 B34.65 T92.08

Craft: Millwright **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	55%	65%	80%	90%					
Benefits	59.25% of	Appren	tice	Wage	Rate	for all	intervals	+ $0.62		

Ratio of Apprentices to Journeymen - 1:3

Craft: Millwright **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- When there are 2 or more Millwrights on a job, 1 shall be designated as a Foreman.

The regular workday shall consist of 8 hours, starting between 6:00 AM and 9:00 AM.

SHIFT DIFFERENTIALS:
- When a 2 shift schedule (including a day shift) is established, the day shift shall be established on an 8 hour basis. The second shift shall be established on an 8 hour basis, and receive the regular rate plus 15%, inclusive of benefits.
- When a three shift schedule is established, the first shift shall be established on an 8 hour basis, the second shift on a 7.5 hour basis, and the third shift on a 7 hour basis. The first shift shall receive the regular hourly rate, the second shift shall receive the regular rate plus 15% and the third shift shall receive the regular rate plus 20%, inclusive of benefits.
- When there is no day shift, and a second or third shift is established, it shall be established on an 8 hour basis. The second shift shall receive the regular rate plus 15% and the third shift shall receive the regular rate plus 20%, inclusive of benefits.
- When an irregular shift must be established, this shift shall receive the regular rate plus 15%, inclusive of benefits.

OVERTIME:
- All hours in excess of 8 per day, or before or after an established shift that are not shift work, and all hours on Saturdays shall be paid at time and one-half the hourly rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the hourly rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday to Thursday, at straight time. Friday may be used as a make-up day for a day lost due to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday. Veterans' Day may be substituted for the day after Thanksgiving.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Operating Engineer **PREVAILING WAGE RATE**

Rates are located in the
"Statewide" rate package

Craft: Operating Engineer **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	60%	70%	80%	90%						

Ratio of Apprentices to Journeymen - *

* 1 apprentice for each piece of heavy equipment. At least 10 pieces of heavy equipment or a minimum of 5 Operating Engineers must be on site.

Craft: Operating Engineer **COMMENTS/NOTES**

Operating Engineer rates are located in the "Statewide" rate package.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Operating Engineer - Field Engineer **PREVAILING WAGE RATE**

Rates are located in the
"Statewide" rate package

Craft: Operating Engineer - Field Engineer **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	70%	75%	of Rod/	Chainman	Wage					
Yearly			80%	90%	Transit/	Instrument	man	Wage		

Ratio of Apprentices to Journeymen - *

* No more than 1 Field Engineer Apprentice per Survey Crew.

Craft: Operating Engineer - Field Engineer **COMMENTS/NOTES**

Operating Engineer - Field Engineer rates are located in the "Statewide" rate package.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Painter - Line Striping **PREVAILING WAGE RATE**

	12/03/24
Apprentice (1st year)	W31.33 B16.18 T47.51
Apprentice (2nd year)	W35.74 B27.13 T62.87
Foreman (Charge Person)	W45.12 B27.91 T73.03
Journeyman 1 (at least 1 year of working exp. as a journeyman)	W40.35 B27.91 T68.26
Journeyman 2 (at least 2 years of working exp. as a journeyman)	W44.12 B27.91 T72.03

Craft: Painter - Line Striping **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									

Ratio of Apprentices to Journeymen - 1:1

Craft: Painter - Line Striping **COMMENTS/NOTES**

OVERTIME:
Hours in excess of 8 per day, Monday through Saturday, and all hours on Sundays and holidays shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans Day, Thanksgiving Day and Christmas Day. Veterans Day may be substituted for the day after Thanksgiving.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Paperhanger **PREVAILING WAGE RATE**

	05/29/24
Foreman	W53.79 B30.71 T84.50
Journeyman	W48.90 B30.71 T79.61

Craft: Paperhanger **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	COMMER	CIAL	PAINTER						

Craft: Paperhanger **COMMENTS/NOTES**

FOREMEN REQUIREMENTS:
- When there are 4 or more Paperhangers on a job, 1 shall be designated a Foreman.

The regular workday shall consist of 8 hours between 7:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- The second shift shall receive an additional 10% of the hourly rate, per hour, and the third shift shall receive an additional 15% of the hourly rate, per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the regular rate. All hours on Sundays and holidays shall be paid at double the regular rate.
- Saturday or Sunday may be used to make up a day lost to inclement weather, at straight time.
- Four 10-hour days may be worked, at straight time, Monday through Friday.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, General Election Day, Veterans Day, Thanksgiving Day, Christmas Day

County - CAMDEN

Craft: Pipefitter **PREVAILING WAGE RATE**

See "Plumber" Rates

Craft: Pipefitter **COMMENTS/NOTES**

*** See PLUMBER Rates***

County - CAMDEN

Craft: Plasterer **PREVAILING WAGE RATE**

See "Cement Mason" Rates

Craft: Plasterer **COMMENTS/NOTES**

See CEMENT MASON Rates

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Plumber **PREVAILING WAGE RATE**

	05/01/24
Foreman	W58.16 B50.51 T108.67
Journeyman	W53.10 B50.51 T103.61

Craft: Plumber **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	30%	35%	45%	50%	55%	60%	65%	70%	75%	80%
Benefits	32.24	33.55	36.16	37.46	38.76	40.06	41.37	42.67	43.99	45.29

Ratio of Apprentices to Journeymen - 1:4

Craft: Plumber **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- On any job having 2 or more Journeyman Plumbers, 1 must be designated a Foreman.
- There must be 1 additional Foreman for every 10 Plumbers on the job.

The regular workday is 8 hours, between 7:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of 5 consecutive workdays.
- When 2 shifts are worked, the second shift shall receive 8 hours pay for 8 hours of work.
- When 3 shifts are worked, the second shift shall receive 8 hours pay for 7.5 hours of work, and the third shift shall receive 8 hours pay for 7 hours of work.
- The rate of pay for all shift work shall be an additional 15% of the hourly rate, per hour.

OVERTIME:
The first 4 hours in excess of 8 per day, or before or after the regular workday that are not shift work, Monday through Friday, and the first 12 hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits. Hours in excess of 12 per day, and all hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Roofer **PREVAILING WAGE RATE**

	05/29/24
Foreman (5 workers or less)	W46.13 B34.77 T80.90
Foreman (6 workers or more)	W46.63 B34.77 T81.40
Journeyman	W44.13 B34.77 T78.90

Craft: Roofer **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	52%	55%	60%	75%						
Benefits	23.39	28.04	34.77	34.77						

Ratio of Apprentices to Journeymen - *

* 1:2, 2:4, 3:6, 4:8, 5:10, 6:12, 7:14

Craft: Roofer **COMMENTS/NOTES**

NOTE: Mopper, Operator of Felt Laying Machine or Slag Dispenser shall receive an additional $.50 per hour.

FOREMAN REQUIREMENTS:
- There must be a Foreman on all jobs.
- Foreman rate depends on the number of Roofers on the job, as indicated.

The regular workday is 8 hours between 5:00 AM and 4:30 PM.

OVERTIME:
Hours in excess of 8 per day, or before or after the regular workday, Monday through Friday, and all hours on Saturdays , Sundays, and holidays shall be paid at time and one-half the wage rate.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Roofer - Shingle, Slate & Tile **PREVAILING WAGE RATE**

	05/29/24
Foreman (3 workers or less)	W34.85 B22.20 T57.05
Foreman (4 workers or more)	W35.35 B22.20 T57.55
Helper	W17.18 B22.20 T39.38
Journeyman (shingle work)	W34.35 B22.20 T56.55

Craft: Roofer - Shingle, Slate & Tile **APPRENTICE RATE SCHEDULE**

INTERVAL	**PERIOD AND RATES**									
Yearly	60%	70%	80%							
Benefits	22.20	22.20	22.20							

Ratio of Apprentices to Journeymen - *

* 1:2, 2:4, 3:6, 4:8, 5:10, 6:12, 7:14

Craft: Roofer - Shingle, Slate & Tile **COMMENTS/NOTES**

NOTE: Above rates are for Shingle work only. Slate and Tile work rates are an additional $3.00 per hour.

HELPER RATIO: 1 Helper to 1 Journeyman

FOREMAN REQUIREMENTS:
- There must be a Foreman on all jobs.
- Foreman rate depends on the number of Roofers on the job, as indicated.

OVERTIME:
Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays, Sundays, and holidays shall be paid at time and one-half the wage rate.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Sheet Metal Sign Installation **PREVAILING WAGE RATE**

	07/31/24
Foreman	W34.32 B25.82 T60.14
Journeyman	W32.32 B25.82 T58.14

Craft: Sheet Metal Sign Installation **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1000 Hours	50%	55%	60%	65%	70%	75%	80%	90%		
Benefits	22.99	23.07	23.14	23.23	24.32	24.40	24.47	24.63		

Ratio of Apprentices to Journeymen - 1:2

Craft: Sheet Metal Sign Installation **COMMENTS/NOTES**

HAZARDOUS DUTY:
Sign Installers working from a bosun's chair or outside swinging scaffold at a height of 60 feet or more: + $5.00 per hour.

FOREMAN REQUIREMENTS:
When there are 3 or more Sign Installers on a job, one must be designated a Foreman.

The regular workday shall be 8 hours, between 8:00 AM and 5:00 PM.

OVERTIME:
Hours in excess of 8 per day, or outside the regular workday, Monday through Friday, and all hours on Saturdays and Sundays shall be paid at time and one-half the regular rate. All hours on holidays shall be paid at time and one-half the regular rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Good Friday, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day, day after Thanksgiving, Christmas Day. Saturday holidays will be observed the preceding Friday, Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Sheet Metal Worker **PREVAILING WAGE RATE**

	05/09/24
Foreman	W63.37 B50.56 T113.93
General Foreman	W67.51 B50.56 T118.07
Journeyman	W59.22 B50.56 T109.78

Craft: Sheet Metal Worker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	45%	55%	60%	65%	70%	75%	85%		
Benefits	30.72	30.75	35.46	35.49	35.52	35.55	35.58	35.63		

Ratio of Apprentices to Journeymen - 1:4

Craft: Sheet Metal Worker **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- When there are 1 to 10 Sheet Metal Workers on a job, 1 must be designated a foreman.
- When there are 11 to 20 Sheet Metal Workers on a job, 1 must be designated a foreman, and 1 must be designated a general foreman.
- When there are 21 or more Sheet Metal Workers on a job, 2 must be designated foremen, and 1 must be designated a general foreman.

The regular workday is 8 hours, between 7:00 AM and 3:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of 5 consecutive workdays.
- When 2 shifts are worked, the second shift shall receive 8 hours pay for 8 hours of work.
- When 3 shifts are worked, the second shift shall receive 8 hours pay for 7.5 hours of work, and the third shift shall receive 8 hours pay for 7 hours of work.
- The rate of pay for all shift work shall be an additional 15% of the regular rate, per hour, inclusive of benefits.

OVERTIME:
The first 2 hours in excess of 8 per day, or before or after the regular workday that are not shift work, and the first 10 hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits. Hours in excess of 10 per day, and all hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Good Friday, Memorial Day, July 4th, Labor Day, General Election Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Sprinkler Fitter **PREVAILING WAGE RATE**

	01/10/25
Foreman	W70.12 B34.25 T104.37
Journeyman	W66.22 B34.25 T100.47

Craft: Sprinkler Fitter **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	19.87	21.19	23.18	26.49	29.80	36.42	43.05	46.36	49.67	52.98
Benefits	13.95	13.95	16.95	24.35	24.85	25.35	25.35	25.85	26.35	27.35

Ratio of Apprentices to Journeymen - 1:4

Craft: Sprinkler Fitter **COMMENTS/NOTES**

The regular workday shall be 8 hours, between 7:00 AM and 4:30 PM.

SHIFT DIFFERENTIALS:
- Second and third shifts shall receive an additional 15% of the hourly rate, per hour.

OVERTIME:
- Hours outside of the regular workday, and the first 2 hours in excess of 8 per day (9th and 10th hours), Monday through Friday, and the first 8 hours on Saturdays shall be paid at time and one-half the hourly rate. Hours in excess of 10 per day, Monday through Friday, hours in excess of 8 on Saturdays, and all hours on Sundays and holidays shall be paid at double the hourly rate.
- Employees may work four 10-hour days at straight time, Monday through Friday, between 7:00 AM and 6:30 PM. The first 2 hours in excess of 10 per day (11th and 12th hours), the first 10 hours on the fifth day, and the first 10 hours on Saturdays shall be paid at time and one-half the hourly rate. Hours in excess of 12 per day, Monday through Friday, and all hours on Sundays and holidays shall be paid at double the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, the day after Thanksgiving, Christmas Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Tile Worker **PREVAILING WAGE RATE**

	06/03/24
Finisher	W43.64 B30.86 T74.50
Setter	W52.32 B36.25 T88.57

Craft: Tile Worker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
750 Hours	40%	45%	50%	55%	60%	65%	70%	75%	80%	90%

Ratio of Apprentices to Journeymen - 1:4

Craft: Tile Worker **COMMENTS/NOTES**

NOTE: These rates also apply to Terrazzo and Marble work.

OVERTIME:
Hours in excess of 8 per day, Monday through Friday, and the first 10 hours on Saturdays shall be paid at time and one half the regular rate, inclusive of benefits. Hours in excess of 10 on Saturdays, and all hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS:
New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day. Sunday holidays shall be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Truck Driver **PREVAILING WAGE RATE**

	05/01/24
Bucket, Tack Spreader trucks	W43.30 B32.37 T75.67
Conrete mobile unit; Seeding/Fertilizing/ Mulching truck	W43.30 B32.37 T75.67
Dump, Water, Form, Vacuum or Vac-All, Pick-up trucks	W43.30 B32.37 T75.67
Helper on Straight 3-axle truck; Mechanic's helper	W43.10 B32.37 T75.47
Mechanics	W43.80 B32.37 T76.17
Shop Steward	W44.65 B32.37 T77.02
Straight 3-axle truck	W43.30 B32.37 T75.67
Tow truck	W43.45 B32.37 T75.82
Tractor-Trailer (any), Fuel, Winch, Asphalt Oil Distributor trucks	W43.65 B32.37 T76.02

Craft: Truck Driver **COMMENTS/NOTES**

HAZARDOUS WASTE WORK:
- On hazardous waste removal work on a State-designated hazardous waste site where the driver is in direct contact with hazardous materials and when personal protective equipment is required for respiratory, skin, and eye protection: + $3.00 per hour.
- All other designated hazardous waste sites: + $1.00 per hour.

SHIFT DIFFERENTIALS:
- Second and Third shifts shall receive an additional $1.50 per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on

Saturdays shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.

- Four 10-hour days may be worked at straight time, Monday through Thursday, with Friday used as a make-up day. If Friday is not a make-up day, then all hours on Friday shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. The day after Thanksgiving may be substituted for Veterans' Day.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAMDEN

Craft: Truck Driver-Material Delivery Driver **PREVAILING WAGE RATE**

	05/01/24
Driver	W37.90 B32.37 T70.27

Craft: Truck Driver-Material Delivery Driver **COMMENTS/NOTES**

These rates apply to delivery of materials TO a jobsite.

SHIFT DIFFERENTIALS:
- Second and Third shifts shall receive an additional $1.50 per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, and all hours on Saturdays shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked at straight time, Monday through Thursday, with Friday used as a make-up day. If Friday is not a make-up day, then all hours on Friday shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. The day after Thanksgiving may be substituted for Veterans' Day.

County - CAMDEN

Craft: Welder **PREVAILING WAGE RATE**

Welder

Craft: Welder **COMMENTS/NOTES**

Welders rate is the same as the craft to which the welding is incidental.

STATEWIDE RATES

TERRITORY
ENTIRE STATE

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PREVAILING WAGE RATE DETERMINATION

OPERATING ENGINEERS **Rates Expiration Date :**

{For apprentice rates refer to "Operating Engineers" apprentice rates in any county rate package}

The regular workday consists of 8 hours, Monday to Friday, between 6:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must be established for 5 consecutive workdays.
- Any work started outside of the allowed start time, 6:00 AM to 9:00 AM, except for * tidal work, shall be considered an irregular shift and paid at straight time, plus 15% for the first eight hours, inclusive of benefits.
- * FOR TIDAL WORK- a contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work), providing the eight hour shift is completed between the hours of 5:00 AM and 6:30 PM.
- All time worked in excess of an established shift (an established shift is a shift that is determined at the time of the bid) shall be paid at the applicable overtime rate. When a portion of an established shift works into Saturday, Sunday or a holiday, that time worked shall be paid at the established shift rate.
- When working with other trades who receive a higher irregular shift differential, these employees shall also receive the higher differential rate.

OVERTIME:
- Hours in excess of 8 per day, or outside of the regular workday, Monday through Friday, that are not shift work, and all hours on Saturday shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sunday and holidays shall be paid at double the regular rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with all hours on Friday paid at time and one-half the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. When all trades on a particular job site agree, the day after Thanksgiving may be substituted for Veterans Day.

For projects bid after April 1, 2020, on hazardous waste removal work of any kind, including a state or federally designated site, where the operating engineer is required to wear level A, B, or C personal protection, the operating engineer shall receive an hourly wage rate of his regular hourly wage plus $5.00 per hour.
- An operating engineer working at a hazardous waste removal project or site at a task requiring hazardous waste related certification, but who is not working in a zone requiring level A, B, or C personal protection, shall receive an hourly wage rate of his regular rate plus $1.00 per hour.

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
58.88	39.15	98.03	100.53

CLASSIFICATIONS:

A-Frame

Backhoe (combination)

Boom Attachment on loaders (Except pipehook)

Boring & Drilling Machine

Brush Chopper, Brush Shredder, Tree Shredder, Tree Shearer

Bulldozer, finish grade

Cableway

Carryall

Concrete Pump

Concrete Pumping System (Pumpcrete & similar types)

Conveyor, 125 feet or longer

Drill Doctor (Duties include dust collector and maintenance)

Front End Loader (2 cu. yds. but less than 5 cu. yds.)

Grader, finish

Groove Cutting Machine (ride-on type)

Heater Planer

Hoist: Outside Material Tower Hoist (all types including steam, gas, diesel, electric, air hydraulic, single and double drum, concrete, brick shaft caisson, snorkle roof, and other similar types, Except Chicago-boom type) * receives an addtional $1.00 per hour on 100 ft. up to 199 ft. total height, and an additional $2.00 per hour on 200 ft. and over total height.

Hydraulic Crane (10 tons & under)

Hydraulic Dredge

Hydro-Axe

Hydro-Blaster

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		**07/01/2025**
Rate	Fringe	Total	Total
58.88	39.15	98.03	100.53

CLASSIFICATIONS:

Jack (screw, air hydraulic, power-operated unit, or console type, Except hand jack or pile load test type)

Log Skidder

Pan

Paver, concrete

Plate & Frame Filter Press

Pumpcrete (unit type)

Pumpcrete, Squeezecrete, or Concrete Pumping machine (regardless of size)

Scraper

Side Boom

Straddle Carrier (Ross and similar types)

Whiphammer

Winch Truck (hoisting)

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
56.97	39.15	96.12	98.62

CLASSIFICATIONS:

Asphalt Curbing Machine

Asphalt Plant Engineer

Asphalt Spreader

Autograde Curb Trimmer & Sidewalk Shoulder Slipform (CMI & similar types)

Autograde Curecrete Machine (CMI & similar types)

Autograde Tube Finisher & Texturing Machine (CMI & similar types)

Bar Bending Machines (Power)

Batcher, Batching Plant, & Crusher [On Site]

Belt Conveyor System

Boom-Type Skimmer Machine

Bridge Deck Finisher

Bulldozer (all sizes)

Captain (Power Boats)

Car Dumper (railroad)

Compressor & Blower unit for loading/unloading of concrete, cement, fly ash, or similar type materials (used independently or truck-mounted)

Compressor (2 or 3 battery)

Concrete Breaking Machine

Concrete Cleaning/Decontamination Machine

Concrete Finishing Machine

Concrete Saw or Cutter (ride-on type)

Concrete Spreader (Hetzel, Rexomatic & similar types)

Concrete Vibrator

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
56.97	39.15	96.12	98.62

CLASSIFICATIONS:

Conveyors - under 125 feet

Crane Signalman

Crushing Machine

Directional Boring Machine

Ditching Machine - Small (Ditchwitch, Vermeer or similar types)

Dope Pot - Mechanical (with or without pump)

Dumpster

Elevator

Fireman

Fork Lift (Economobile, Lull & similar types)

Front End Loader (1 cu. yd. and over but less than 2 cu. yds.)

Generator (2 or 3 battery)

Giraffe Grinder

Goldhofer/Hydraulic Jacking Trailer

Grader & Motor Patrols

Grout Pump

Gunnite Machine (Excluding nozzle)

Hammer - Vibratory (in conjunction with generator)

Heavy Equipment Robotics - Operator/Technician

Hoist (roof, tugger, aerial platform hoist, house car)

Hopper

Hopper Doors (power operated)

Ladder (motorized)

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
56.97	39.15	96.12	98.62

CLASSIFICATIONS:

Laddervator

Locomotive (Dinky-type)

Maintenance Utility Man

Master Environmental Maintenance Technician

Mechanic

Mixer (Except paving mixers)

Pavement Breaker (truck-mounted or small self-propelled ride-on type)

Pavement Breaker - maintenance of compressor or hydraulic unit

Pipe Bending Machine (power)

Pitch Pump

Plaster Pump (regardless of size)

Post Hole Digger (post pounder, auger)

Rod Bending Machines

Roller (black top)

Scale (power)

Seamen Pulverizing Mixer

Shoulder Widener

Silo

Skimmmer Machine (boom type)

Steel Cutting Machine (service & maintenance)

Tamrock Drill

Tractor

Transfer Machines

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
56.97	39.15	96.12	98.62

CLASSIFICATIONS:

Tug Captains

Tug Master (Power Boats)

Ultra High Pressure Waterjet Cutting Tool System - Operator/Maintenance Technician

Vacuum Blasting Machine - Operator/Maintenance Technician

Vibrating Plant (used with unloading)

Welder & Repair Mechanic

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
51.63	39.15	90.78	93.28

CLASSIFICATIONS:

Assistant Engineer/Oiler

Driller's Helper

Field Engineer - Transit man or Instrument man

Maintenance Apprentice (Deckhand)

Maintenance Apprentice (Oiler)

Mechanic's Helper

Off Road Back Dump

Tire Repair & Maintenance

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
49.05	39.15	88.20	90.70

CLASSIFICATIONS:

Field Engineer - Rodman or Chainman

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
59.21	39.15	98.36	100.86

CLASSIFICATIONS:

Lead Engineer, Foreman Engineer, Safety Engineer (minimum)

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
60.47	39.15	99.62	102.12

CLASSIFICATIONS:

Autograde Pavement Profiler (CMI & similar types)

Autograde Pavement Profiler - Recycle Type (CMI & similar types)

Autograde Placer/Trimmer/Spreader Combination (CMI & similar types)

Autograde Slipform Paver (CMI & similar types)

Backhoe (Excavator)

Central Power Plant

Concrete Paving Machine

Cranes, Derricks, Pile Drivers (all types), under 100 tons with a boom (including jib and/or leads) under 100 ft.

Draglines

Drill, Bauer, AMI and similar types

Drillmaster, Quarrymaster

Drillmaster/Quarrymaster (down-the-hole drill), rotary drill, self-propelled hydraulic drill, self-powered drill

Elevator Grader

Field Engineer-Chief of Party

Front End Loader (5 cu. yards or larger)

Gradall

Grader, Rago

Helicoptor Co-Pilot

Helicoptor Communications Engineer

Juntann Pile Driver

Locomotive (large)

Mucking Machine

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		**07/01/2025**
Rate	Fringe	Total	Total
60.47	39.15	99.62	102.12

CLASSIFICATIONS:

Pavement & Concrete Breaker (Superhammer & Hoe Ram)

Pile Driver

Prentice Truck

Roadway Surface Grinder

Scooper (loader & shovel)

Shovel (Excavator)

Trackhoe (Excavator)

Tree Chopper with boom

Trenching Machine (cable plow)

Tunnel Boring Machine

Vacuum Truck

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
55.34	39.15	94.49	96.99

CLASSIFICATIONS:

Chipper

Compressor (single)

Concrete Spreader (small type)

Conveyor Loader (Except elevator graders)

Engines, Large Diesel (1620 HP) & Staging Pump

Farm Tractor

Fertilizing Equipment (operation & maintenance)

Fine Grade Machine (small type)

Form Line Grader (small type)

Front End Loader (under 1 cubic yard)

Generator (single)

Grease, Gas, Fuel, & Oil Supply Trucks

Heaters (Nelson or other type)

Lights - portable generating light plant

Mixer, Concrete (small)

Mulching Equipment (operation & maintenance)

Power Broom or Sweeper

Pump (diesel engine & hydraulic - regardless of power)

Pump (larger than 2 inch suction, including submersible pumps)

Road Finishing Machine (small type)

Roller - grade, fill, or stone base

Seeding Equipment (operation & maintenance)

Sprinkler & Water Pump Trucks

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
55.34	39.15	94.49	96.99

CLASSIFICATIONS:

Steam Generator or Boiler

Stone Spreader

Tamping Machine (vibrating ride-on type)

Temporary Heating Plant (Nelson or other type, including proprane, natural gas, and flow-type units)

Water or Sprinkler Truck

Welding Machine (gas, diesel, or electric convertor, of any type)

Welding System - Multiple (rectifier transformer type)

Wellpoint Systems (including installation by bull gang and maintenance)

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
62.29	39.15	101.44	103.94

CLASSIFICATIONS:

Helicoptor Pilot/Engineer

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
66.97	39.15	106.12	108.62

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types), 100 tons and over and TOWER CRANE with boom (including jib and/or leads) 140 ft. and over

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
65.97	39.15	105.12	107.62

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types), 100 tons and over and TOWER CRANE with boom (including jib and/or leads) from 100 ft. to 139 ft.

OPERATING ENGINEERS **Rates Expiration Date :**

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
62.47	39.15	101.62	104.12

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types) , under 100 tons with a boom (including jib and/or leads) 140 ft. and over

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
64.97	39.15	104.12	106.62

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types), 100 tons and over and TOWER CRANE with a boom (including jib and/or leads) under 100 ft.

Effective Dates:

	07/01/2024		07/01/2025
Rate	Fringe	Total	Total
61.47	39.15	100.62	103.12

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types), under 100 tons with a boom (including jib and/or leads) from 100 ft. to 139 ft.

STRUCTURAL STEEL ERECTION **Rates Expiration Date :**

{For apprentice rates refer to "Operating Engineers" apprentice rates in any county rate package}

The regular workday consists of 8 hours, Monday to Friday, between 6:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must be established for 5 consecutive workdays.
- Any work started outside of the allowed start time, 6:00 AM to 9:00 AM, except for * tidal work, shall be considered an irregular shift and paid at straight time, plus 15% for the first eight hours, inclusive of benefits.
- * FOR TIDAL WORK- a contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work), providing the eight hour shift is completed between the hours of 5:00 AM and 6:30 PM.
- All time worked in excess of an established shift (an established shift is a shift that is determined at the time of the bid) shall be paid at the applicable overtime rate. When a portion of an established shift works into Saturday, Sunday or a holiday, that time worked shall be paid at the established shift rate.
- When working with other trades who receive a higher irregular shift differential, these employees shall also receive the higher differential rate.

OVERTIME:
- Hours in excess of 8 per day, or outside of the regular workday, Monday through Friday, that are not shift work, and all hours on Saturday shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sunday and holidays shall be paid at double the regular rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with all hours on Friday paid at time and one-half the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. When all trades on a particular job site agree, the day after Thanksgiving may be substituted for Veterans Day.

For projects bid after April 1, 2020, on hazardous waste removal work of any kind, including a state or federally designated site, where the operating engineer is required to wear level A, B, or C personal protection, the operating engineer shall receive an hourly wage rate of his regular hourly wage plus $5.00 per hour.
- An operating engineer working at a hazardous waste removal project or site at a task requiring hazardous waste related certification, but who is not working in a zone requiring level A, B, or C personal protection, shall receive an hourly wage rate of his regular rate plus $1.00 per hour.

Effective Dates:

	07/01/2024		**07/01/2025**
Rate	Fringe	Total	Total
64.10	39.15	103.25	105.75

CLASSIFICATIONS:

Helicopter Co-Pilot & Communications Engineer

STRUCTURAL STEEL ERECTION **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
60.04	39.15	99.19	101.69

CLASSIFICATIONS:

A-Frame

Cherry Picker -10 tons or less (Over 10 tons use crane rate)

Hoist (all types Except Chicago-boom)

Jack (screw, air hydraulic, power-operated unit or console type, Except hand jack or pile load test type)

Side Boom

Straddle Carrier

STRUCTURAL STEEL ERECTION **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
57.38	39.15	96.53	99.03

CLASSIFICATIONS:

Aerial Platform Used On Hoists

Apprentice Engineer/Oiler with Compressor or Welding Machine

Captain (Power Boats)

Compressor (2 or 3 in battery)

Concrete Cleaning/Decontamination Machine Operator

Conveyor or Tugger Hoist

Directional Boring Machine

Elevator or House Car

Fireman

Forklift

Generator (2 or 3)

Heavy Equipment Robotics, Operator/Technician

Maintenance Utility Man

Master Environmental Maintenance Technician

Tug Master (Power Boats)

Ultra High Pressure Waterjet Cutting Tool System Operator/Maintenance Technician

Vacuum Blasting Machine Operator/Maintenance Technician

Welding Machines, Gas or Electric Converters on any type-2 or 3 in battery including diesels

STRUCTURAL STEEL ERECTION **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
55.85	39.15	95.00	97.50

CLASSIFICATIONS:

Compressor (Single)

Generators

Welding Machines, Gas, Diesel, Or Electric Converters of any type-single

Welding System, Multiple (Rectifier Transformer Type)

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
52.09	39.15	91.24	93.74

CLASSIFICATIONS:

Assistant Engineer/Oiler

Drillers Helper

Field Engineer - Transit/Instrument Man

Maintenance Apprentice (Deckhand)

Maintenance Apprentice (Oiler)

Off Road Back Dump

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
59.66	39.15	98.81	101.31

CLASSIFICATIONS:

Lead Engineer, Foreman Engineer, Safety Engineer (Minimum)

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
49.05	39.15	88.20	90.70

CLASSIFICATIONS:

Field Engineer - Rodman or Chainman

STRUCTURAL STEEL ERECTION **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
60.80	39.15	99.95	102.45

CLASSIFICATIONS:

Field Engineer-Chief of Party

Vacuum Truck

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
68.99	39.15	108.14	110.64

CLASSIFICATIONS:

Cranes (all cranes, land or floating with booms, including jib, 140 ft. and over, above ground). Derricks (all derricks, land, floating or Chicago Boom type with booms including jib, 140 ft. and over, above ground), and Pile Drivers (all types) 100 tons and over and Tower Cranes.

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
67.33	39.15	106.48	108.98

CLASSIFICATIONS:

Cranes (all cranes, land or floating with booms including jib, less than 140 ft. abovr ground), Derricks (all derricks. land, floating or Chicago Boom type with booms including jib, less than 140 ft. above ground), Pile Drivers (all types), 100 tons and over and Tower Crane.

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
64.49	39.15	103.64	106.14

CLASSIFICATIONS:

Cranes (all cranes, land or floating with booms including jib, 140 ft. and over, above ground), Derricks (all derricks, land, floating or Chicago Boom type with booms including jib, 140 ft. and over, above ground), Pile Drivers (all types), under 100 tons.

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
62.83	39.15	101.98	104.48

CLASSIFICATIONS:

Cranes (all cranes, land or floating with booms including jib, less than 140 ft. above ground), Derricks (all derricks, land, floating or Chicago Boom type with booms including jib, less than 140 ft. above ground), Pile Drivers (all types), under 100 tons.

STRUCTURAL STEEL ERECTION **Rates Expiration Date :**

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
64.49	39.15	103.64	106.14

CLASSIFICATIONS:

Helicopter Pilot & Engineer

TEST BORING PRELIMINARY TO CONSTRUCTION-SOUTH/WEST **Rates Expiration Date :**

THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY:
Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Hunterdon, Mercer, Monmouth, Ocean, Salem, Sussex, Warren

The regular workday consists of 8 hours, Monday to Friday, between 6:00 AM and 5:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must be established for 5 consecutive workdays.
- Any work started outside of the allowed start time, 6:00 AM to 9:00 AM, except for * tidal work, shall be considered an irregular shift and paid at straight time, plus 15% for the first eight hours, inclusive of benefits.
- * FOR TIDAL WORK- a contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work), providing the eight hour shift is completed between the hours of 5:00 AM and 6:30 PM.
- All time worked in excess of an established shift (an established shift is a shift that is determined at the time of the bid) shall be paid at the applicable overtime rate. When a portion of an established shift works into Saturday, Sunday or a holiday, that time worked shall be paid at the established shift rate.
- When working with other trades who receive a higher irregular shift differential, these employees shall also receive the higher differential rate.

OVERTIME:
- Hours in excess of 8 per day, or outside of the regular workday, Monday through Friday, that are not shift work, and all hours on Saturday shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sunday and holidays shall be paid at double the regular rate, inclusive of benefits.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with all hours on Friday paid at time and one-half the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. When all trades on a particular job site agree, the day after Thanksgiving may be substituted for Veterans Day.

For projects bid after April 1, 2020, on hazardous waste removal work of any kind, including a state or federally designated site, where the operating engineer is required to wear level A, B, or C personal protection, the operating engineer shall receive an hourly wage rate of his regular hourly wage plus $5.00 per hour.
- An operating engineer working at a hazardous waste removal project or site at a task requiring hazardous waste related certification, but who is not working in a zone requiring level A, B, or C personal protection, shall receive an hourly wage rate of his regular rate plus $1.00 per hour.

Effective Dates:

	07/01/2024		**07/01/2025**
Rate	Fringe	Total	Total
60.47	39.15	99.62	102.12

CLASSIFICATIONS:

Driller

Effective Dates:

	07/01/2024		**07/01/2025**
Rate	Fringe	Total	Total
53.63	39.15	92.78	95.28

CLASSIFICATIONS:

Driller's Helper

FREE AIR TUNNEL JOBS **Rates Expiration Date :**

{For apprentice rates refer to "Heavy & General" apprentice rates in any county rate package}

The regular workday consists of 8 hours, starting at 7:00 AM or 8:00 AM.

SHIFT DIFFERENTIALS:
- Shifts must start at 3:00 PM, 4:00 PM, 12:00 AM, or 1:00 AM, to be considered shift work, except when the project owner mandates special hours of work in the job specifications, in which case those hours may be considered shift work.
- When such hours are mandated by the project owner, a shift that begins before midnight on Friday and ends on Saturday morning, or that begins at or after 8:00 PM on Sunday and ends on Monday morning may be paid at the shift differential rate.
- Shifts shall receive an additional $3.00 per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, or outside of the regular workday that are not shift work, and all hours on Saturdays, shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be substituted for the day after Thanksgiving. However, in the trading of Veterans Day for the day after Thanksgiving, if overtime is worked on Veterans Day, it shall be paid at double the hourly rate.

Hazardous Waste Work:
-where Level A, B, or C protection is required: + $5.00/hr
-other Hazardous Waste site: + $1.00/hr

Traffic Control Coordinator: When either of the work classifications found below are working as a Traffic Control Coordinator they are to receive $.75 above their current rate of pay.

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
65.06	37.33	102.39	106.26	109.94

CLASSIFICATIONS:

Walking Boss & Superintendent

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
64.69	37.33	102.02	105.88	109.57

CLASSIFICATIONS:

Heading Foreman, Shaft Foreman, Rod Foreman, Electrician Foreman, Rigging Foreman

FREE AIR TUNNEL JOBS **Rates Expiration Date :**

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
64.06	37.33	101.39	105.26	108.94

CLASSIFICATIONS:

Iron Foreman, Caulking Foreman, Form Foreman, Cement Finishing Foreman, Concrete Foreman, Track Foreman, Cleanup Foreman, Grout Foreman

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
67.19	37.33	104.52	108.38	112.07

CLASSIFICATIONS:

Blaster

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
63.38	37.33	100.71	104.57	108.26

CLASSIFICATIONS:

Top Labor Foreman

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
62.94	37.33	100.27	104.13	107.82

CLASSIFICATIONS:

Skilled Men (including Caulker, Powder Carrier, all other skilled men)

Skilled Men (including Miner, Drill Runner, Iron Man, Conveyor Man, Manitenance Man, Safety Miner, Rigger, Block Layer, Cement Finisher, Tod Man)

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
62.75	37.33	100.08	103.94	107.63

CLASSIFICATIONS:

Semi-Skilled Men (including Bell or Signal Man Top or Bottom, Form Worker & Mover, Concrete Worker, Shaft Man, Tunnel Laborer, Caulker's Helper, all other semi-skilled)

Semi-Skilled Men (including Miner's Helper, Chuck Tender, Track Man, Nipper, Brake Man, Derail Man, Cable Man, Hose Man, Gravel Man, Form Man)

FREE AIR TUNNEL JOBS **Rates Expiration Date :**

Effective Dates:

04/17/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
62.25	37.33	99.58	103.44	107.13

CLASSIFICATIONS:

All Others (including Powder Watchman, Change House Attendant, Top Laborer)

DRILL FOR GROUND WATER SUPPLY **Rates Expiration Date :**

The well driller and/or helper may perform all work relative to the construction, finishing, and servicing of wells, pumps and borings for ground water supply. The present methods of well drilling entailing as they do, many diverse job operations calling for drilling, pump discharge, piping, and the operation of various types of related power equipment, shall all be within the job duties and functions of the well driller and/or helper. In the event that an extension of work should occur beyond water well drilling functions, into the field of general construction work, such extension of work would come under the appropriate rates listed elsewhere in this wage determination.

- For Work Hours, Shift Differentials, Overtime Rates, and Recognized Holidays see the "Operating Engineers" section of this wage determination.

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
59.22	39.15	98.37	100.87

CLASSIFICATIONS:

Driller

Effective Dates:

07/01/2024			07/01/2025
Rate	Fringe	Total	Total
52.38	39.15	91.53	94.03

CLASSIFICATIONS:

Driller's Helper

OPERATING ENGINEERS MARINE-DREDGING **Rates Expiration Date :**

NOTE: These wage rates only apply to dredging and other marine construction activities occurring in navigable waters and their tributaries.
Boat crews carrying explosive material (dynamite, pourfex, and other similar materials) shall be paid at 120% of the hourly wage rate for hours engaged in handling of said materials. Employees required to possess a Hazardous Material Certification as a condition of employment shall be compensated at 120% of the hourly wage rate.
OVERTIME:
Hours in excess of 40 per week, and all hours on Saturdays and Sundays, shall be paid at time and one-half the hourly rate. All hours on holidays shall be paid at double the hourly rate.
RECOGNIZED HOLIDAYS: New Year's Day, Martin Luther King Day, Good Friday, Memorial Day, July 4th, Labor Day, Veterans Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday.

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
47.07	15.34	62.41	63.92	65.74

CLASSIFICATIONS:

Lead Dredgerman, Operator, Leverman

Licensed Tug Operator with MOTV, Deck Captain

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
40.71	14.90	55.61	56.92	58.47

CLASSIFICATIONS:

Derrick Operator, Spider/Spill Barge Operator

Engineer, Electrician, Chief Welder, Chief Mate

Fill Placer, Operator II

Licensed Boat Operator

Maintenance Engineer

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
38.31	14.73	53.04	54.27	55.75

CLASSIFICATIONS:

Certified Welder

OPERATING ENGINEERS MARINE-DREDGING **Rates Expiration Date :**

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
37.26	14.66	51.92	53.12	54.54

CLASSIFICATIONS:

Mate, Drag Barge Operator, Steward, Assistant Fill Placer

Welder

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
36.07	14.57	50.64	51.80	53.18

CLASSIFICATIONS:

Boat Operator

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
29.96	14.15	44.11	45.07	46.22

CLASSIFICATIONS:

Shoreman, Deckhand, Rodman, Scowman

Effective Dates:

10/03/2024			10/01/2025	10/01/2026
Rate	Fringe	Total	Total	Total
41.94	14.99	56.93	58.27	59.89

CLASSIFICATIONS:

Crane Operator

MICROSURFACING/SLURRY SEAL **Rates Expiration Date :**

THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY:
Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Ocean, Salem
IN ALL OTHER COUNTIES use the Heavy and General Laborers - North "Slurry Seal Laborer" rates.

SHIFT DIFFERENTIALS:
Any shift starting at 3:30 PM or later shall receive an additional $0.35/hr

OVERTIME:
Hours in excess of 8 per day or 40 per week shall be paid at time and one-half the hourly rate. All hours on holidays shall be paid at double the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Washington's Birthday, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day.

Effective Dates:

03/01/2017

Rate	Fringe	Total
36.50	21.27	57.77

CLASSIFICATIONS:

Foreman

Effective Dates:

03/01/2017

Rate	Fringe	Total
33.80	21.27	55.07

CLASSIFICATIONS:

Box man

Effective Dates:

03/01/2017

Rate	Fringe	Total
31.75	21.27	53.02

CLASSIFICATIONS:

Microsurface/Slurry Preparation

Effective Dates:

03/01/2017

Rate	Fringe	Total
31.75	21.27	53.02

CLASSIFICATIONS:

Squeegee man

MICROSURFACING/SLURRY SEAL **Rates Expiration Date :**

Effective Dates:

03/01/2017

Rate	Fringe	Total
30.30	21.27	51.57

CLASSIFICATIONS:

Cleaner, Taper

ASPHALT LABORERS - SOUTH **Rates Expiration Date :**

"THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Ocean, Salem
{For apprentice rates refer to "Laborer - Heavy & General" apprentice rates in any county rate package}
The regular workday consists of 8 hours, starting at 7:00 AM or 8:00 AM.
SHIFT DIFFERENTIALS:
- Shifts must start at 3:00 PM, 4:00 PM, 12:00 AM, or 1:00 AM, to be considered shift work, except when the project owner mandates special hours of work in the job specifications, in which case those hours may be considered shift work.
- When such hours are mandated by the project owner, a shift that begins before midnight on Friday and ends on Saturday morning, or that begins at or after 8:00 PM on Sunday and ends on Monday morning may be paid at the shift differential rate.
- Shifts shall receive an additional $3.00 per hour.
OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, or outside of the regular workday that are not shift work, and all hours on Saturdays, shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate.
RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be substituted for the day after Thanksgiving. However, in the trading of Veterans Day for the day after Thanksgiving, if overtime is worked on Veterans Day, it shall be paid at double the hourly rate.
Hazardous Waste Work:
-where Level A, B, or C protection is required: + $5.00/hr
-other Hazardous Waste site: + $1.00/hr
FOR TIDE WORK (pertains to tidal water): A contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work) providing the eight (8) hour shift is completed between the hours of 5:00 AM and 6:30 PM.

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
53.55	37.33	90.88	94.33	97.58

CLASSIFICATIONS:

Paving Foreman

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.10	37.33	87.43	90.88	94.13

CLASSIFICATIONS:

Head Raker

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.25	37.33	87.58	91.03	94.28

CLASSIFICATIONS:

Screedman

ASPHALT LABORERS - SOUTH **Rates Expiration Date :**

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
49.70	37.33	87.03	90.48	93.73

CLASSIFICATIONS:

Tampers, Smoothers, Kettlemen, Painters, Shovelers, Roller Boys

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
49.80	37.33	87.13	90.58	93.83

CLASSIFICATIONS:

Milling Controller

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.00	37.33	87.33	90.78	94.03

CLASSIFICATIONS:

Traffic Control Coordinator

Effective Dates:

03/21/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
49.95	37.33	87.28	90.73	93.98

CLASSIFICATIONS:

Raker, Luteman

Effective Dates:

Rate	Fringe	Total

CLASSIFICATIONS:

Certified Paving Foreman

TEST BORING PRELIMINARY TO CONSTRUCTION-NORTH **Rates Expiration Date :**

THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY:
Bergen, Essex, Hudson, Middlesex, Morris, Passaic, Somerset, Union

SHIFT DIFFERENTIAL:
Employees on a shift other than between the hours of 8:00 AM and 5:00 PM shall receive an additional $2.00 per hour.

OVERTIME:
Hours in excess of 8 per day, Monday through Friday, and all hours on Saturday shall be paid at time and one-half the regular rate. All hours on Sundays and holidays shall be paid at double the regular rate.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, and Christmas Day. Sunday holidays observed the following Monday.

Hazardous Waste Pay (for Levels A, B, and C): an additional 15% of the hourly rate, per hour.

A newly hired Helper with no experience in the industry shall be paid as follows:
1st year on the job - 70% of Helper wage rate
2nd year on the job - 80% of Helper wage rate
3rd year on the job - 90% of Helper wage rate
All helpers receive full fringe benefit rate.

Effective Dates:

10/18/2024

Rate	Fringe	Total
37.58	34.49	72.07

CLASSIFICATIONS:

Helper (4th year helper)

Effective Dates:

10/18/2024

Rate	Fringe	Total
47.88	34.49	82.37

CLASSIFICATIONS:

Driller

Effective Dates:

10/18/2024

Rate	Fringe	Total
54.50	34.49	88.99

CLASSIFICATIONS:

Foreman

HEAVY & GENERAL LABORERS - NORTH **Rates Expiration Date :**

THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY:
Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, Warren

{For apprentice rates refer to "Laborer - Heavy & General" apprentice rates in any county rate package}

The regular workday consists of 8 hours, starting at 7:00 AM or 8:00 AM.

SHIFT DIFFERENTIALS:
- Shifts must start at 3:00 PM, 4:00 PM, 12:00 AM, or 1:00 AM, to be considered shift work, except when the project owner mandates special hours of work in the job specifications, in which case those hours may be considered shift work.
- When such hours are mandated by the project owner, a shift that begins before midnight on Friday and ends on Saturday morning, or that begins at or after 8:00 PM on Sunday and ends on Monday morning may be paid at the shift differential rate.
- Shifts shall receive an additional $3.00 per hour.
FOR TIDE WORK (pertains to tidal water): A contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work) providing the eight (8) hour shift is completed between the hours of 5:00 AM and 6:30 PM.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, or outside of the regular workday that are not shift work, and all hours on Saturdays, shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be substituted for the day after Thanksgiving. However, in the trading of Veterans Day for the day after Thanksgiving, if overtime is worked on Veterans Day, it shall be paid at double the hourly rate.

Hazardous Waste Work:
-where Level A, B, or C protection is required: + $5.00/hr
-other Hazardous Waste site: + $1.00/hr

Effective Dates:

	11/12/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
49.30	37.33	86.63	90.08	93.33

CLASSIFICATIONS:

"D" Rate:
basic, landscape, asphalt, slurry seal, or railroad track laborer; utility meter installer; flagman; salamander tender; pitman; dumpman; rakers or tampers on cold patch work; wrappers or coaters of pipe; waterproofer; timberman; wagon drill or drill master helper; powder carrier; magazine tender; signal man; power buggy operator; tree cutter; operator of basic power tools

Effective Dates:

	11/12/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
50.00	37.33	87.33	90.78	94.03

CLASSIFICATIONS:

"C" Rate:
pipe layer; laser man; conduit or duct line layer; operator of jack hammer, chipping hammer, pavement breaker, concrete cutter, asphalt cutter, sheet hammer, or walk-behind saw cutter; sandblaster; acetylene cutting or burning; wagon drill, directional drill, or hydraulic drill operator; drill master; core driller; asphalt raker or lute man

HEAVY & GENERAL LABORERS - NORTH **Rates Expiration Date :**

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.25	37.33	87.58	91.03	94.28

CLASSIFICATIONS:

"B" Rate:
concrete finisher; setter of brick or stone pavers; stone cutter; form setter; manhole, catch basin, or inlet builder; asphalt screedman; rammer; hardscaping; gunite nozzle man

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
53.80	37.33	91.13	94.58	97.83

CLASSIFICATIONS:

"A" Rate:
blaster

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
53.55	37.33	90.88	94.33	97.58

CLASSIFICATIONS:

"FOREMAN" Rate:
labor foreman, asphalt foreman, drill foreman, pipe foreman, grade foreman, finisher foreman, concrete foreman

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
54.55	37.33	91.88	95.33	98.58

CLASSIFICATIONS:

"GENERAL FOREMAN" Rate

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.75	37.33	88.08	91.53	94.78

CLASSIFICATIONS:

TRAFFIC CONTROL COORDINATOR Rate

HEAVY & GENERAL LABORERS - NORTH **Rates Expiration Date :**

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
54.05	37.33	91.38	95.83	100.08

CLASSIFICATIONS:

" CERTIFIED FOREMAN Rate" :

Effective Dates:

11/12/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
55.05	37.33	92.38	96.83	101.08

CLASSIFICATIONS:

" CERTIFIED GENERAL FOREMAN Rate" :

HEAVY & GENERAL LABORERS - SOUTH **Rates Expiration Date :**

THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY:
Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Ocean, Salem

{For apprentice rates refer to "Laborer - Heavy & General" apprentice rates in any county rate package}

The regular workday consists of 8 hours, starting at 7:00 AM or 8:00 AM.

SHIFT DIFFERENTIALS:
- Shifts must start at 3:00 PM, 4:00 PM, 12:00 AM, or 1:00 AM, to be considered shift work, except when the project owner mandates special hours of work in the job specifications, in which case those hours may be considered shift work.
- When such hours are mandated by the project owner, a shift that begins before midnight on Friday and ends on Saturday morning, or that begins at or after 8:00 PM on Sunday and ends on Monday morning may be paid at the shift differential rate.
- Shifts shall receive an additional $3.00 per hour.

FOR TIDE WORK (pertains to tidal water): A contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work) providing the eight (8) hour shift is completed between the hours of 5:00 AM and 6:30 PM.
OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, or outside of the regular workday that are not shift work, and all hours on Saturdays, shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be substituted for the day after Thanksgiving. However, in the trading of Veterans Day for the day after Thanksgiving, if overtime is worked on Veterans Day, it shall be paid at double the hourly rate.

Hazardous Waste Work:
-where Level A, B, or C protection is required: + $5.00/hr
-other Hazardous Waste site: + $1.00/hr

Effective Dates:

	12/31/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
49.30	37.33	86.63	90.08	93.33

CLASSIFICATIONS:

"D" Rate:
basic, landscape, asphalt, slurry seal, or railroad track laborer; utility meter installer; flagman; salamander tender; pitman; dumpman; rakers or tampers on cold patch work; wrappers or coaters of pipe; waterproofer; timberman; wagon drill or drill master helper; powder carrier; magazine tender; signal man; power buggy operator; tree cutter; operator of basic power tools

Effective Dates:

	12/31/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
50.00	37.33	87.33	90.78	94.03

CLASSIFICATIONS:

"C" Rate:
pipe layer; laser man; conduit or duct line layer; operator of jack hammer, chipping hammer, pavement breaker, concrete cutter, asphalt cutter, sheet hammer, or walk-behind saw cutter; sandblaster; acetylene cutting or burning; wagon drill, directional drill, or hydraulic drill operator; drill master; core driller; asphalt raker or lute man

HEAVY & GENERAL LABORERS - SOUTH **Rates Expiration Date :**

Effective Dates:

12/31/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
53.80	37.33	91.13	94.58	97.83

CLASSIFICATIONS:

"A" Rate:
blaster

Effective Dates:

12/31/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
53.55	37.33	90.88	94.33	97.58

CLASSIFICATIONS:

"FOREMAN" Rate:
labor foreman, asphalt foreman, drill foreman, pipe foreman, grade foreman, finisher foreman, concrete foreman

Effective Dates:

12/31/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
54.55	37.33	91.88	95.33	98.58

CLASSIFICATIONS:

"GENERAL FOREMAN" Rate

Effective Dates:

12/31/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.75	37.33	88.08	91.53	94.78

CLASSIFICATIONS:

TRAFFIC CONTROL COORDINATOR Rate

Effective Dates:

12/31/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
55.05	37.33	92.38	96.83	101.08

CLASSIFICATIONS:

" CERTIFIED GENERAL FOREMAN Rate" :

HEAVY & GENERAL LABORERS - SOUTH **Rates Expiration Date :**

Effective Dates:

12/31/2024			03/01/2025	03/03/2026
Rate	Fringe	Total	Total	Total
54.05	37.33	91.38	95.83	100.08

CLASSIFICATIONS:

" CERTIFIED FOREMAN Rate" :

Effective Dates:

12/31/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.25	37.33	87.58	91.03	94.28

CLASSIFICATIONS:

"B" Rate:
concrete finisher; setter of brick or stone pavers; stone cutter; form setter; manhole, catch basin, or inlet builder; asphalt screedman; rammer; hardscaping; gunite nozzle man

PIPELINE - MAINLINE TRANSMISSION **Rates Expiration Date :**

These rates apply to the following: welding on Transportation Mainline pipe lines (cross-country pipe lines, or any segments thereof, transporting coal, gas, oil, water or other transportable materials, vapors or liquids, including portions of such pipe lines within private property boundaries up to the final metering station or connection - the point where a valve, consumer connection, or town border station divides mainline transmission lines or higher pressure lateral and branch lines from lower pressure distribution systems).

PER DIEM PAYMENT:
In addition to the total wage rate paid for each craft, the following per diem (per day) amounts must also be paid - Pipeline Journeyman: $80.50; Pipeline Journeyman Welder: $140.50; and Pipeline Helper: $64.50. Note: in order to receive the per diem payment an employee must work a minimum of 8 hours in a 24 hour period.

NOTES:
- Journeymen employed as "stringer bead" welders and journeymen who are regularly employed as "hot-pass" welders shall receive $1.00 per hour more than other journeymen.
- Welders running "stringer bead" or "hot-pass" on "cutouts" or "tie-ins" on a production basis shall be paid $1.00 per hour above the journeymen rate.
- Whenever a welder helper is employed using a power buffer or power grinder immediately behind the stringer bead and/or hot-pass welders, and the pipe gang is set on a production basis, the helper shall be paid $2.00 per hour above the helper rate.
- If back welding is performed inside a pipe under either or both of the following conditions, the welder engaged in the welding will receive $3.00 per hour above the regular rate for the job only for the days on which such back welding is performed:
  - The employer elects, as a regular procedure, to back weld each line-up. This condition is not intended to apply to occasional back welding performed by the pipe gang to repair a bead, to rectify a "high-lo" condition or wall thickness, etc.
  - A welder is required to back weld a completed weld behind the firing line.
- If the welder helper is required to go inside the pipe for the purpose of brushing, buffing and grinding the weld, they shall receive a wage rate $1.00 per hour above the regular
helper rate for the days involved.
- Welders working on "hot work" shall be paid $2.00 per hour above the regular rate for each day engaged in such work. "Hot work' is defined as work on lines in service where there is the danger of fire or explosion.

The regular workday shall be 8 hours, between 8:00 AM and 4:30 PM.

OVERTIME:
Hours in excess of 8 per day, and all hours on Sundays shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, July 4th, Labor Day, Thanksgiving Day, and Christmas Day. Sunday holidays observed the following Monday.

Effective Dates:

	06/13/2024	
Rate	Fringe	Total
57.34	35.90	93.24

CLASSIFICATIONS:

Pipeline Journeyman Welder

PIPELINE - MAINLINE TRANSMISSION **Rates Expiration Date :**

Effective Dates:

06/13/2024

Rate	Fringe	Total
57.34	35.90	93.24

CLASSIFICATIONS:

Pipeline Journeyman

Effective Dates:

06/13/2024

Rate	Fringe	Total
33.84	25.02	58.86

CLASSIFICATIONS:

Pipeline Helper

PIPELINE - GAS DISTRIBUTION **Rates Expiration Date :**

These rates apply to the following: welding on gas line distribution systems (that portion of the gas distribution system placed in streets, roads, subways, tunnels, viaducts, highways and easements which serves the users of gas).

SHIFT DIFFERENTIALS:
An "irregular" shift may start any time from 5:00 PM to 12:00 AM, Monday through Friday, and shall receive an additional 15% of the regular rate per hour, inclusive of benefits.

OVERTIME:
Hours in excess of forty per week, and all hours on Saturdays shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the regular rate, inclusive of benefits.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, and Christmas Day. Sunday holidays observed the following Monday.

Effective Dates:

11/04/2024

Rate	Fringe	Total
64.70	34.74	99.44

CLASSIFICATIONS:

Pipeline Journeyman Welder

Effective Dates:

11/04/2024

Rate	Fringe	Total
64.70	34.74	99.44

CLASSIFICATIONS:

Pipeline Journeyman

Effective Dates:

11/04/2024

Rate	Fringe	Total
41.73	24.77	66.50

CLASSIFICATIONS:

Pipeline Helper

ASPHALT LABORERS- NORTH **Rates Expiration Date :**

THESE RATES APPLY IN THE FOLLOWING COUNTIES ONLY:
Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, Warren
{For apprentice rates refer to "Laborer - Heavy & General" apprentice rates in any county rate package}
The regular workday consists of 8 hours, starting at 7:00 AM or 8:00 AM.
SHIFT DIFFERENTIALS:
- Shifts must start at 3:00 PM, 4:00 PM, 12:00 AM, or 1:00 AM, to be considered shift work, except when the project owner mandates special hours of work in the job specifications, in which case those hours may be considered shift work.
- When such hours are mandated by the project owner, a shift that begins before midnight on Friday and ends on Saturday morning, or that begins at or after 8:00 PM on Sunday and ends on Monday morning may be paid at the shift differential rate.
- Shifts shall receive an additional $3.00 per hour.
OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, or outside of the regular workday that are not shift work, and all hours on Saturdays, shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate.
RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be substituted for the day after Thanksgiving. However, in the trading of Veterans Day for the day after Thanksgiving, if overtime is worked on Veterans Day, it shall be paid at double the hourly rate.
Hazardous Waste Work:
-where Level A, B, or C protection is required: + $5.00/hr
-other Hazardous Waste site: + $1.00/hr
FOR TIDE WORK (pertains to tidal water): A contractor can start their job according to tide schedules (tide schedules are the various high and low tides related to this work) providing the eight (8) hour shift is completed between the hours of 5:00 AM and 6:30 PM.

Effective Dates:

11/20/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
53.55	37.33	90.88	94.33	97.58

CLASSIFICATIONS:

Asphalt Foreman

Effective Dates:

11/20/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.25	37.33	87.58	91.03	94.28

CLASSIFICATIONS:

Asphalt Screedman

Effective Dates:

11/20/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
50.00	37.33	87.33	90.78	94.03

CLASSIFICATIONS:

Asphalt Raker or Lute Man

ASPHALT LABORERS- NORTH **Rates Expiration Date :**

Effective Dates:

11/20/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
49.30	37.33	86.63	90.08	93.33

CLASSIFICATIONS:

Asphalt Laborer

Effective Dates:

11/20/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
54.05	37.33	91.38	95.83	100.08

CLASSIFICATIONS:

Certified Asphalt Foreman

ELECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date :**

Electrician-Utility Work (North)
(For apprentice rates refer to Electrician-Utility Work (North) in any county rate package).
These rates apply to work contracted for by the following utility companies:
Public Service Electric & Gas Co. of NJ, GPU Energy, Borough of Madison Electric Department, Sussex Rural Electric Cooperative, Rockland Utilities, and Butler Municipal Electric Co.
These rates do not apply to work on substations or switching stations.
For Utility work contracted for by a utility company other than those listed above or those listed under "Electrician-Utility Work (South), see the "Outside Commercial Rates" for the county in which the jobsite is located.

* FOR OUTSIDE COMMERCIAL RATES PLEASE SEE COUNTY RATES

The regular workday is 8 hours, between 6:00 AM and 6:00 PM.
FOR EMERGENCY WORK ONLY: (emergency work is defined as work caused by storm, catastrophe, act of god, and circumstances beyond the control of the employer)-all hours of work shall be paid at double the hourly rate.
SHIFT DIFFERENTIALS:
Shift work must run for a minimum of 5 consecutive workdays.
2nd shift (between the hours of 4:30 PM and 1:00 AM): 8 hours of work + 17.3% of the regular rate, inclusive of benefits.
3rd shift (between the hours of 12:30 AM and 9:00 AM): 8 hours of work + 31.4% of the regular rate per hour, inclusive of benefits.

OVERTIME:
Hours in excess of 8 per day, or before or after the regular wokday Monday through Friday, that is not shift work, and all hours on Saturday shall be paid at time and one-half the regular rate, inclusive of benefits. All hours on Sundays and holidays shall be paid at double the hourly rate, inclusive of benefits.
Four 10-hour days may worked, at straight time, between 6:00 AM and 6:00 PM, Monday through Thursday.

RECOGNIZED HOLIDAYS:
New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day and Christmas Day, or day on which they are legally observed.

Effective Dates:

12/01/2024

Rate	Fringe	Total
64.83	44.73	109.56

CLASSIFICATIONS:

Chief Lineman

Effective Dates:

12/01/2024

Rate	Fringe	Total
61.16	42.20	103.36

CLASSIFICATIONS:

Journeyman Lineman

ELECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date :**

Effective Dates:

12/01/2024

Rate	Fringe	Total
61.16	42.20	103.36

CLASSIFICATIONS:

Special License Operator

Effective Dates:

12/01/2024

Rate	Fringe	Total
60.55	41.77	102.32

CLASSIFICATIONS:

Transit Man

Effective Dates:

12/01/2024

Rate	Fringe	Total
58.71	40.50	99.21

CLASSIFICATIONS:

Line Equipment Operator

Effective Dates:

12/01/2024

Rate	Fringe	Total
51.37	35.44	86.81

CLASSIFICATIONS:

Dynamite Man

Effective Dates:

12/01/2024

Rate	Fringe	Total
76.45	52.75	129.20

CLASSIFICATIONS:

General Foreman

Effective Dates:

12/01/2024

Rate	Fringe	Total
70.33	48.52	118.85

CLASSIFICATIONS:

Assistant General Foreman

ELECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date :**

Effective Dates:

12/01/2024

Rate	Fringe	Total
68.50	47.26	115.76

CLASSIFICATIONS:

Line Foreman

Effective Dates:

12/01/2024

Rate	Fringe	Total
49.54	34.18	83.72

CLASSIFICATIONS:

Street Light Mechanical Leader

Effective Dates:

12/01/2024

Rate	Fringe	Total
47.09	32.49	79.58

CLASSIFICATIONS:

Groundman Winch Operator

Effective Dates:

12/01/2024

Rate	Fringe	Total
47.09	32.49	79.58

CLASSIFICATIONS:

Groundman Truck Operator

Effective Dates:

12/01/2024

Rate	Fringe	Total
46.48	32.07	78.55

CLASSIFICATIONS:

Street Light Mechanic

Effective Dates:

12/01/2024

Rate	Fringe	Total
46.48	32.07	78.55

CLASSIFICATIONS:

Line Equipment Mechanic

ELECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date :**

Effective Dates:

12/01/2024

Rate	Fringe	Total
39.75	27.42	67.17

CLASSIFICATIONS:

Groundman 2nd Year

Effective Dates:

12/01/2024

Rate	Fringe	Total
36.70	25.32	62.02

CLASSIFICATIONS:

Groundman 1st Year

Effective Dates:

12/01/2024

Rate	Fringe	Total
60.55	41.77	102.32

CLASSIFICATIONS:

Line Equipment Foreman

ELECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date :**

Electrician-Utility Work (South)
(For apprentice rates refer to Electrician-Utility Work (South) in any county rate package).
These rates apply to work contracted for by the following utility company:
Atlantic City Electric.
These rates do not apply to work on substations or switching stations.
For utility work contracted for by a utility company other than the one listed above or those listed under "Electrician-Utility Work (North), see the "Outside Commercial Rates" for the county in which the jobsite is located.

* FOR OUTSIDE COMMERCIAL RATES PLEASE SEE COUNTY RATES

The regular workday is 8 hours, between 7:00 AM and 4:30 PM.
FOR EMERGENCY WORK ONLY: (emergency work is defined as work caused by storm, catastrophe, act of god, and circumstances beyond the control of the employer)- all hours of work shall be paid at double the hourly rate.
SHIFT DIFFERENTIALS:
Shift work must run for a minimum of 5 consecutive workdays.
When two (2) or three (3) shifts are worked the following shall apply:
1st shift (between the hours of 8:00 AM and 4:30 PM)
2nd shift (between the hours of 4:30 PM and 12:30 AM): 8 hours of work + 10% of the regular rate of pay for 7.5 hours worked.

3rd shift (between the hours of 12:30 AM and 8:00 AM): 8 hours of work + 15% of the regular rate of pay for 7 hours worked.

OVERTIME:
Hours in excess of 8 per day, or before or after the regular wokday Monday through Friday, that is not shift work, and all hours on Saturday shall be paid at time and one-half the regular rate. All hours on Sundays and Holidays shall be paid double the hourly rate.

Four 10-hour days may be worked, at straight time, between 6:00 AM and 6:00 PM, Monday through Thursday with Friday used as a make-up day.

RECOGNIZED HOLIDAYS:
New Year's Day, Memorial Day, July 4th, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day or on days celebrated.

WORKING RULES:
There shall be a Foreman in charge of each work crew. No crews are to exceed twelve (12) men, including Foremen.

There shall be a General Foreman designated for transmission work when three (3) or more crews are on the same job and for distribution work where there are are more than twenty (20) employees on site.
A small job crew shall consist of five (5) or less employees, one (1) of the Journeyman Linemen in the crew shall be designated as a Small Job Foreman.
Work performed from ladders and/or mechanical lift equipment shall be the work of Linemen and/or Apprentices.
On new construction, fitting and framing poles, towers or structures may be done by Journeymen and/or Apprentices. Groundmen may assist, but may not perform any work which would be performed by Linemen if assembled in the air.
There shall be a Journeyman Lineman in each pole setting, erection, grounding, wire and cable-pulling crew of more than three (3) men.

Effective Dates:

12/01/2024

Rate	Fringe	Total
71.87	59.12	130.99

CLASSIFICATIONS:

General Foreman

ELECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date :**

Effective Dates:

12/01/2024

Rate	Fringe	Total
64.01	54.22	118.23

CLASSIFICATIONS:

Foreman

Effective Dates:

12/01/2024

Rate	Fringe	Total
60.64	52.12	112.76

CLASSIFICATIONS:

Small Job Foreman

Effective Dates:

12/01/2024

Rate	Fringe	Total
56.15	49.33	105.48

CLASSIFICATIONS:

Heavy Equipment Operator

Effective Dates:

12/01/2024

Rate	Fringe	Total
56.15	49.33	105.48

CLASSIFICATIONS:

Cable Splicer

Effective Dates:

12/01/2024

Rate	Fringe	Total
56.15	49.33	105.48

CLASSIFICATIONS:

Journeyman Lineman

Effective Dates:

12/01/2024

Rate	Fringe	Total
56.15	49.33	105.48

CLASSIFICATIONS:

Journeyman Welder

ELECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date :**

Effective Dates:

12/01/2024

Rate	Fringe	Total
56.15	49.33	105.48

CLASSIFICATIONS:

Journeyman Painter

Effective Dates:

12/01/2024

Rate	Fringe	Total
44.92	42.36	87.28

CLASSIFICATIONS:

Light Equipment Operator

Effective Dates:

12/01/2024

Rate	Fringe	Total
39.31	38.86	78.17

CLASSIFICATIONS:

Groundman Truck Driver

Effective Dates:

12/01/2024

Rate	Fringe	Total
36.50	37.12	73.62

CLASSIFICATIONS:

Groundman 3rd Year

Effective Dates:

12/01/2024

Rate	Fringe	Total
33.69	35.37	69.06

CLASSIFICATIONS:

Groundman 2nd Year

Effective Dates:

12/01/2024

Rate	Fringe	Total
30.88	33.62	64.50

CLASSIFICATIONS:

Groundman 1st Year

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PREVAILING WAGE RATE DETERMINATION

ELECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date :**

Effective Dates:

12/01/2024

Rate	Fringe	Total
24.71	29.80	54.51

CLASSIFICATIONS:

Flagman

HEAVY & GENERAL LABORERS- NEW TRANS HUDSON TUNNELS **Rates Expiration Date :**

THESE RATES APPLY TO CONSTRUCTION ON NEW TRANS HUDSON TUNNELS ONLY

{For apprentice rates refer to "Laborer - Heavy & General" apprentice rates in any county rate package}

The regular workday consists of 8 hours, starting at 7:00 AM or 8:00 AM.

SHIFT DIFFERENTIALS:
- Shifts must start at 3:00 PM, 4:00 PM, 12:00 AM, or 1:00 AM, to be considered shift work, except when the project owner mandates special hours of work in the job specifications, in which case those hours may be considered shift work.
- When such hours are mandated by the project owner, a shift that begins before midnight on Friday and ends on Saturday morning, or that begins at or after 8:00 PM on Sunday and ends on Monday morning may be paid at the shift differential rate.
- Shifts shall receive an additional $3.00 per hour.

OVERTIME:
- Hours in excess of 8 per day, Monday through Friday, or outside of the regular workday that are not shift work, and all hours on Saturdays, shall be paid at time and one-half the hourly rate. All hours on Sundays and holidays shall be paid at double the hourly rate.
- Four 10-hour days may be worked, Monday through Thursday, at straight time, with Friday used as a make-up day for a day lost to inclement weather. If Friday is not a make-up day, all hours on Friday shall be paid at time and one-half the hourly rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be substituted for the day after Thanksgiving. However, in the trading of Veterans Day for the day after Thanksgiving, if overtime is worked on Veterans Day, it shall be paid at double the hourly rate.

Hazardous Waste Work:
-where Level A, B, or C protection is required: + $5.00/hr
-other Hazardous Waste site: + $1.00/hr

Traffic Control Coordinator: When either of the work classifications found below are working as a Traffic Control Coordinator they are to receive $.75 above their current rate of pay.

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
78.08	37.33	115.41	119.68	123.81

CLASSIFICATIONS:

Walking Boss & Superintendent

Effective Dates:

	04/17/2024		**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
77.63	37.33	114.96	119.23	123.36

CLASSIFICATIONS:

Heading Foreman, Shaft Foreman, Rod Foreman, Electrical Foreman, Rigging Foreman

HEAVY & GENERAL LABORERS- NEW TRANS HUDSON TUNNELS **Rates Expiration Date :**

Effective Dates:

04/17/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
76.88	37.33	114.21	118.48	122.61

CLASSIFICATIONS:

Iron Foreman, Caulking Foreman, Form Foreman, Cement Finishing Foreman, Concrete Foreman, Track Foreman, Clean-up Foreman, Grout Foreman

Effective Dates:

04/17/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
80.63	37.33	117.96	122.23	126.36

CLASSIFICATIONS:

Blaster

Effective Dates:

04/17/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
76.05	37.33	113.38	117.66	121.78

CLASSIFICATIONS:

Top Labor Foreman

Effective Dates:

04/17/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
75.53	37.33	112.86	117.13	121.26

CLASSIFICATIONS:

Skilled Men (including Caulker, Powder Carrier, all other skilled men)
Skilled Men (including Miner, Drill Runner, Iron Man, Conveyor Man, Maintenance Man, Safety Miner, Rigger, Block Layer, Cement Finisher, Rod Man)

Effective Dates:

04/17/2024			03/01/2025	03/01/2026
Rate	Fringe	Total	Total	Total
75.30	37.33	112.63	116.91	121.03

CLASSIFICATIONS:

Semi-Skilled Men (including Bell or Signal Man top or bottom, Form Worker & Mover, Concrete Worker, Shaft Man, Tunnel Laborer, Caulker's Helper, all other semi-skilled)
Semi-Skilled Men (including Miner's Helper, Chuck Tender, Track Man, Nipper, Brake Man, Derail Man, Cable Man, Hose Man, Gravel Man, Form Man)

TERRITORY

ENTIRE STATE

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

HEAVY & GENERAL LABORERS- NEW TRANS HUDSON TUNNELS **Rates Expiration Date :**

Effective Dates:

04/17/2024			**03/01/2025**	**03/01/2026**
Rate	Fringe	Total	Total	Total
74.70	37.33	112.03	116.31	120.43

CLASSIFICATIONS:

All others (including Powder Watchman, Change House Attendant, Top Laborer, Job Steward)

APPENDIX D

FEDERAL WAGE RATES

"General Decision Number: NJ20250001 02/14/2025

Superseded General Decision Number: NJ20240001

State: New Jersey

Construction Type: Highway

Counties: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Monmouth, Ocean and Salem Counties in New Jersey.

HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number Publication Date

0 01/03/2025
1 02/07/2025
2 02/14/2025

BRNJ0002-002 05/01/2021

	Rates	Fringes
Bricklayer	$ 45.20	33.26

Work 100 degrees F. and over:
to be paid at the rate of double time.

Work on high stacks:
22% per hour additional.

BRNJ0002-003 05/01/2021

DOES NOT INCLUDE BUILDING CONSTRUCTION IN MERCER COUNTY - SEE SUNJ1993-001

	Rates	Fringes
Cement mason	$ 45.20	33.26

Cement mason:
Epoxy, acid and latex work: $.50 per hour additional.

CARP0006-005 05/01/2024

	Rates	Fringes
Carpenter	$ 56.01	59.25%+$0.14

CARP0454-002 05/01/2023

ATLANTIC, BURLINGTON, CAMDEN, CAPE MAY, CUMBERLAND, GLOUCESTER, OCEAN AND SALEM COUNTIES:

	Rates	Fringes
Piledriver	$ 46.73	41.69

PAID HOLIDAYS:
New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day; provided that the worker works any of the three days in the five-day work week preceding the holiday and the first work day after the holiday.

CARP1556-002 05/01/2024

MERCER AND MONMOUTH COUNTIES:

	Rates	Fringes
Dock Builder & Piledrivermen	$ 52.98	52.44

Work on land pile driving, while handling and working with creosote and creosote-impregnated products: $.25 per hour

additional.

Work on hazardous/toxic/contaminated waste removal, on a hazardous/toxic/contaminated waste site, where the worker comes into contact with hazardous/toxic/contaminated waste material, and when A, B or C personal protective equipment is required and used for respiratory, skin or eye protection: 20% per hour additional.

ELEC0269-003 10/01/2017

BURLINGTON COUNTY (north of a line following the west and south limits of Burlington Borough from the Delaware River, in a southeasterly direction, to the Burlington - Mt. Holly road; then, south-southeast along the Burlington - Mt. Holly road to the town of Mt. Holly, includes Mt. Holly; then, east along the Pennsylvania Railroad to the town of New Lisbon, includes New Lisbon; then, continuing along the Pennsylvania Railroad to the Ocean County line); MERCER COUNTY:

	Rates	Fringes
Line construction:		
Continuous pipe-type underground oil-filled transmission conduit installations:		
Ground person; truck with winch operator	$ 39.83	60.93%
Line technician; cable splicer; heavy equipment operator	$ 49.79	60.93%
All other work:		
Ground person; truck with winch operator	$ 39.83	60.93%
Line technician; cable splicer; heavy equipment operator	$ 49.79	60.93%

ELEC0269-004 01/02/2023

BURLINGTON COUNTY (north of a line following the west and south limits of Burlington Borough from the Delaware River, in a southeasterly direction, to the Burlington - Mt. Holly road; then, south-southeast along the Burlington - Mt. Holly road to the town of Mt. Holly, includes Mt. Holly; then, east along the Pennsylvania Railroad to the town of New Lisbon, includes New Lisbon; then, continuing along the Pennsylvania Railroad to the Ocean County line); MERCER COUNTY:

	Rates	Fringes
ELECTRICIAN		
Cable Splicer	$ 52.71	62.48%
Electrician	$ 54.27	65.20%

ELEC0351-001 09/30/2024

ATLANTIC COUNTY; BURLINGTON COUNTY (south of a line following the west and south limits of Burlington Borough from the Delaware River, in a southeasterly direction, to the Burlington - Mt. Holly road; then, south-southeast along the Burlington -

Mt. Holly road to the town of Mt. Holly, does not include Mt. Holly; then, east along the Pennsylvania Railroad to the town of New Lisbon, does not include New Lisbon; then, continuing along the Pennsylvania Railroad to the Ocean County line); CAMDEN, CAPE MAY, CUMBERLAND, GLOUCESTER AND SALEM COUNTIES:

	Rates	Fringes
Electricians:		
Cable splicer on lead cable.	$ 46.51	72.54% + .65
Electrician and cable splicer	$ 55.05	77.77%+5.95

ELEC0351-002 12/01/2024

ATLANTIC COUNTY; BURLINGTON COUNTY (south of a line following the west and south limits of Burlington Borough from the Delaware River, in a southeasterly direction, to the Burlington - Mt. Holly road; then, south-southeast along the Burlington - Mt. Holly road to the town of Mt. Holly, does not include Mt. Holly; then, east along the Pennsylvania Railroad to the town of New Lisbon, does not include New Lisbon; then, continuing along the Pennsylvania Railroad to the Ocean County line); CAMDEN, CAPE MAY, CUMBERLAND, GLOUCESTER AND SALEM COUNTIES:

	Rates	Fringes
Line construction:		
Groundmen	$ 30.88	58.42%+14.42
Heavy equipment operator	$ 44.92	58.42%+14.42
Lineman	$ 56.15	58.42%+14.42

ELEC0400-001 06/03/2024

MONMOUTH AND OCEAN COUNTIES:

	Rates	Fringes
Electrician & Cable Splicer	$ 55.99	44.24

ELEC0400-002 05/30/2022

MONMOUTH AND OCEAN COUNTIES:

	Rates	Fringes
Line construction:		
Continuous pipe-type underground oil-filled transmission conduit installations:		
Electrical installation equipment operators: Hole-digging equipment; truck with winch or pole, and steel hand; truck without winch; ground person	$ 30.30	20.60
Equipment service person	$ 53.12	38.81
Line technician, cable splicer, x-ray technician, and equipment repair person	$ 53.35	38.81
Line technician/welder	$ 53.35	38.81

All other work:		
Ground person	$ 37.35	27.17
Line technician, cable splicer, and equipment operator	$ 53.35	38.81

Work with hazardous materials: 10% per hour additional.

ENGI0825-002 07/01/2024

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 60.47	36.25
GROUP 2	$ 58.88	36.25
GROUP 3	$ 56.97	36.25
GROUP 4	$ 55.34	36.25
GROUP 5	$ 51.63	36.25
GROUP 6	$ 62.29	36.25

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous material, and when personal protective equipment is required for respiratory, skin and eye protection: 20% per hour additional.

PAID HOLIDAYS:
New Year's Day, Washington's Birthday observed, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day; provided 1) that the worker works three of the preceding five work days before the holiday; or, the work day before the holiday and the work day after the holiday; and, 2) that the worker works the work day before and the work day after the holiday.

DEFINITION OF GROUPS:

GROUP 1:
Autograde - combination subgrader; base metal spreader and base trimmer (CMI and similar types); autograde placer - trimmer spreader combination (CMI and similar types); autograde slipform paver (CMI and similar types); backhoe; central power plant (all types); concrete paving machine; crane (all types, including overhead and straddle traveling type); crane, gantry; derrick (land, floating or Chicago boom type); drillmaster, quarrymaster (down-the-hole drill, rotary drill, self-propelled hydraulic drill, self-powered drill); dragline; elevating grader; front end loader (5 cu. yd. and over); gradall; grader, raygo; locomotive (large); mucking machine; pavement and concrete breaker (superhammer and hoe ram); pile driver (length of boom, including length of leads, shall determine premium rate applicable); roadway surface grinder; scooper (loader and shovel); shovel; tree chopper with boom; trench machine (cable plow)

GROUP 2:
""A"" frame/backhoe combination; boom attachment on loader (rate based on size of bucket, not applicable to pipehook); boring and drilling machine; brush chopper, shredder and tree shredder; carryall; concrete pump; concrete pumping system, pumpcrete and similar type; conveyor, 125 ft. and

over; drill doctor, including dust collecting and maintenance work; front end loader (2 cu. yd. but less than 5 cu. yd.); grader (finish); groove cutting machine (ride-on type); heater planer; hoist (all types of hoist, shall also include steam, gas, diesel, electric, air, hydraulic, single and double drum, concrete, brick shaft caisson, snorkel roof, and/or any other similar type hoisting machine, portable or stationary, except Chicago boom type) (if hoist is ""outside material tower hoist"", long boom rate is to be applied); hydraulic crane, 10 tons and under; hydro-axe; hydro-blaster; jack (screw, air, hydraulic power-operated unit or console type (not hand jack or pile load test type); log skidder; pan; pavers (all) (concrete); plate and frame filter press; pumpcrete machine; squeezecrete; concrete pump (regardless of size); scraper; side boom; straddle carrier, Ross and similar type; whip hammer; winch truck (hoisting)

GROUP 3:
Asphalt curbing machine; asphalt plant engineer; asphalt spreader; autograde tube finishing and texturing machine (CMI and similar types); autograde curecrete machine (CMI and similar types); autograde curb trimmer and sidewalk, shoulder, slipform (CMI and similar types); bar bending machine (power); batcher; batching plant and crusher on site; belt conveyor system; boom-type skimmer machine; bridge deck finisher; bulldozers (all); car dumper (railroad); compressor and blower-type unit (used independently or mounted on dual-purpose truck, on jobsite or in conjunction with jobsite, in loading and unloading of concrete, cement, fly ash, instantcrete, or similar type materials); compressor (2 or 3) (in battery) (within 100 ft.); concrete cleaning/decontamination machine operator, when used for decontamination and remediation; concrete finishing machine; concrete saw and cutter (ride-on type); concrete spreader, hetzel, rexomatic and similar type; concrete vibrator; conveyor, under 125 ft.; crushing machine; directional boring machine; ditching machine, small (Ditchwitch, Vermeer or similar type); dope pot (mechanical with or without pump); dumpster; elevator; firefighter; forklift (Economobile, Lull and similar type of equipment); front end loader (1 cu. yd. and over but less than 2 cu. yd.); generator (2 or 3) (in battery) (within 100 ft.); giraffe grinder; grader and motor patrol; gunite machine (does not include nozzle); hammer, vibratory (in conjunction with generator); heavy equipment robotic operator/technician, when used for decontamination and remediation; hoist (roof, tugger, aerial platform hoist and house cars); hopper; hopper door (power-operated); ladder (motorized); laddervator; locomotive, dinky type; maintenance, utility person; master environmental maintenance technician, when used for decontamination and remediation; mechanic; mixer (except paving mixer); pavement breaker, small, self-propelled ride-on type (also maintains compressor on hydraulic unit); pavement breaker, truck-mounted; pipe bending machine (power); pitch pump; plaster pump, regardless of size; posthole digger (post pounder and auger); rod bending machine (power); roller, blacktop; scale, power; seaman pulverizing mixer; shoulder widener; silo; skimmer machine (boom type); steel cutting machine, servicing and maintaining; tractor; captain, power boat; tug master, power boat; ultra high-pressure waterjet cutting tool system operator/maintenance technician, when used for decontamination and remediation; vacuum blasting machine operator/maintenance technician, when used for

decontamination and remediation; vibrating plant (used in conjunction with unloading); welder and repair mechanic

GROUP 4:
Broom and sweeper; chipper; compressor (single); concrete spreader (small type); conveyor loader (does not include elevating grader); engine, large diesel (1620 H.P.) and staging pump; farm tractor; fertilizing equipment (operation and maintenance of); fine grade machine (small type); form line grader (small type); front end loader (under 1 cu. yd.); generator (single); grease, gas, fuel and oil supply truck; heater (Nelson or other type including propane, natural gas or flow-type unit); lights (portable generating light plant); mixer, concrete, small; mulching equipment (operation and maintenance of); off-road back dump; pump (4-in. suction and over, including submersible pump); pump (diesel engine and hydraulic) (immaterial of power); road finishing machine (small type); roller, grade, fill or stone base; seeding equipment (operation and maintenance of); sprinkler and water pump truck; steam jenny and boiler; stone spreader; tamping machine, vibrating ride-on; temporary heating plant (Nelson or other type, including propane, natural gas or flow-type unit); welding machine (gas, diesel, and/or electric converter of any type) (single, or two or three in a battery) (within 100 ft.); welding system, multiple (rectifier, transformer type); wellpoint system

GROUP 5:
Oiler; tire repair and maintenance

GROUP 6:
Helicopter pilot; helicopter engineer

ENGI0825-004 07/01/2024

	Rates	Fringes
Power equipment operators:		
Steel erection:		
GROUP 1	$ 68.99	36.25
GROUP 2	$ 67.33	36.25
GROUP 3	$ 64.49	36.25
GROUP 4	$ 60.04	36.25
GROUP 5	$ 57.38	36.25
GROUP 6	$ 55.85	36.25
GROUP 7	$ 52.09	36.25

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous material, and when personal protective equipment is required for respiratory, skin and eye protection: 20% per hour additional.

PAID HOLIDAYS:
New Year's Day, Washington's Birthday observed, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day; provided 1) that the worker works three of the preceding five work days before the holiday; or, the work day before the holiday and the work day after the holiday; and, 2) that the worker works the work day before and the work day

after the holiday.

DEFINITION OF GROUPS:

GROUP 1:
Cranes (all cranes, land or floating with boom including jib, 140 ft. and over, above ground); derricks (all derricks, land, floating or Chicago boom type with boom including jib, 140 ft. and over, above ground)

GROUP 2:
Cranes (all cranes, land or floating with boom including jib, less than 140 ft. above ground); derricks (all derricks, land, floating or Chicago boom type with boom including jib, less than 140 ft. above ground)

GROUP 3:
Helicopter pilot

GROUP 4:
""A"" frame; cherry picker (10 ton and under); hoist (all types of hoist, including steam, gas, diesel, electric, air, hydraulic, single and double drum, concrete, brick shaft caisson, or any other similar type of hoisting machine, portable or stationary, except Chicago boom type); jack (screw, air, hydraulic power-operated unit or console type (not hand jack or pile load test type); side boom; straddle carrier

GROUP 5:
Aerial platform used as a hoist; compressor, two or three in battery; directional boring machine; elevator or house car; concrete cleaning/decontamination machine operator, decontamination and remediation work only; conveyor and tugger hoist; firefighter; forklift; generator, two or three in battery; heavy equipment robotic operator/technician, decontamination and remediation work only; maintenance, utility person; master environmental maintenance technician, decontamination and remediation work only; rod bending machine (power); ultra high-pressure waterjet cutting tool system operator/maintenance technician, decontamination and remediation work only; vacuum blasting machine operator/maintenance technician, decontamination and remediation work only; welding machine (gas or electric, two or three in battery, including diesel); captain, power boat; tug master, power boat; oiler, with either one compressor or one welding machine

GROUP 6:
Compressor, single; off-road back dump; welding machine (single, gas, diesel and electric converters of any type); welding system, multiple (rectifier, transformer type); generator, single

GROUP 7:
Oiler; deckhand

IRON0011-001 07/01/2024

MONMOUTH COUNTY; OCEAN COUNTY (north third of county):

	Rates	Fringes

Ironworkers:		
Reinforcing	$ 48.44	49.37
Structural	$ 50.74	49.37

IRON0399-001 07/01/2024

	Rates	Fringes
Ironworker	$ 54.24	38.40

IRON0399-008 07/01/2024

ATLANTIC COUNTY; BURLINGTON COUNTY (south and east of a line starting from the point on the Atlantic-Burlington county line where the Atlantic-Burlington county line crosses Route 206; then, following a line northeast through Wharton State Park to the town of Chatsworth; then, continuing along the same line, to the Burlington-Ocean county line); CAPE MAY COUNTY; CUMBERLAND COUNTY (east of a line drawn from the Delaware Bay through the town of Cedarville and north to the point where the county lines of Atlantic, Cumberland and Gloucester Counties meet); OCEAN COUNTY (south third of county):

	Rates	Fringes
Ironworkers:		
HIGHWAY CONSTRUCTION:		
Fence and guardrail	$ 51.77	37.65
Precast and structural	$ 54.24	38.40
Reinforced concrete	$ 53.24	38.40

* LABO0172-001 03/01/2024

HIGHWAY CONSTRUCTION:

	Rates	Fringes
Laborers:		
Group 1	$ 49.30	36.73
Group 2	$ 50.00	36.73
Group 3	$ 50.25	36.73
Group 4	$ 53.80	36.73

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is required to wear Level A, B or C personal protection: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site, where the worker is not required to wear Level A, B, or C personal protection: $1.00 per hour additional.

PAID HOLIDAYS:
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day; provided that the worker works three days for the same employer within a period of ten working days consisting of five working days before and five working days after the day upon which the holiday falls or is observed.

DEFINITION OF GROUPS:

GROUP 1:
  Basic laborer; landscape laborer; railroad track laborer;
  utility meter installer; traffic director/flag person;
  salamander tender; pit person; dump person; asphalt laborer
  (only in Monmouth County); slurry seal laborer (only in
  Monmouth County); raker and tamper on cold patch work;
  wrapper and coater of pipe; waterproofing laborer; timber
  person; powder carrier; magazine tender; signal person;
  power buggy operator; tree cutter; and the operation of
  such other basic power tools used to perform work usually
  done manually by laborers

GROUP 2:
  Pipelayer; laser person; conduit and duct line layer;
  jackhammer; chipping hammer; pavement breaker; concrete
  cutter; asphalt cutter; sheet hammer operator;
  sandblasting, acetylene cutting and burning; wagon drill
  operator; directional drill operator; hydraulic drill
  operator; drill master; core driller; traffic control
  coordinator; asphalt raker/lute person (only in Monmouth
  County); walk-behind saw cutter

GROUP 3:
  Finisher; rammer; setter of brick or stone pavers;
  hardscaping; gunite nozzle person; stonecutter; form
  setter; manhole; catch basin and inlet builder; asphalt
  screedperson (only in Monmouth County)

GROUP 4:
  Blaster

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* LABO0172-003 03/01/2024

ATLANTIC, BURLINGTON, CAMDEN, CAPE MAY, CUMBERLAND, GLOUCESTER,
MERCER, OCEAN AND SALEM COUNTIES:

	Rates	Fringes
Laborers:		
HIGHWAY CONSTRUCTION:		
ASPHALT WORK:		
GROUP 1	$ 49.30	36.73
GROUP 2	$ 50.00	36.73
GROUP 3	$ 50.25	36.73
GROUP 4	$ 53.80	36.73

PAID HOLIDAYS:
  New Year's Day, President's Day, Memorial Day,
  Independence Day, Labor Day, Presidential Election Day,
  Veteran's Day, Thanksgiving Day and Christmas Day; provided
  that the worker works three days for the same employer
  within a period of ten working days, consisting of five
  working days before and five working days after the day
  upon which the holiday falls or is observed.

DEFINITION OF GROUPS:

GROUP 1:
  Basic laborer; landscape laborer; railroad track laborer;
  utility meter installer; traffic director/flag person;
  salamander tender; pit person; dump person; asphalt laborer

(only in Bergen, Essex, Hudson and Hunterdon Counties; Middlesex County (north of the Raritan River); Morris, Passaic, Somerset, Sussex, Union and Warren Counties); slurry seal laborer (only in Bergen, Essex, Hudson and Hunterdon Counties; Middlesex County (north of the Raritan River); Morris, Passaic, Somerset, Sussex, Union and Warren Counties); raker and tamper on cold patch work; wrapper and coater of pipe; waterproofing laborer; timber person; powder carrier; magazine tender; signal person; power buggy operator; tree cutter; and the operation of such other basic power tools used to perform work usually done manually by laborers

GROUP 2:
Pipelayer; laser person; conduit and duct line layer; jackhammer; chipping hammer; pavement breaker; concrete cutter; asphalt cutter; sheet hammer operator; sandblasting, acetylene cutting and burning; wagon drill operator; directional drill operator; hydraulic drill operator; drill master; core driller; traffic control coordinator; asphalt raker/lute person (only in Bergen, Essex, Hudson and Hunterdon Counties; Middlesex County (north of the Raritan River); Morris, Passaic, Somerset, Sussex, Union and Warren Counties); walk-behind saw cutter

GROUP 3:
Finisher; rammer; setter of brick or stone pavers; hardscaping; gunite nozzle person; stonecutter; form setter; manhole; catch basin and inlet builder; asphalt screedperson (only in Bergen, Essex, Hudson and Hunterdon Counties; Middlesex County (north of the Raritan River); Morris, Passaic, Somerset, Sussex, Union and Warren Counties)

GROUP 4:
Blaster

PAIN0711-009 02/01/2024

	Rates	Fringes
Painters:		
Work on bridges (all bridges that span major waterways, railroad bridges, bridges over canyons, overpasses)	$ 59.29	33.56

PAIN0711-014 05/01/2015

	Rates	Fringes
Painters:		
All other work:		
Brush and roller	$ 37.76	21.50
Spray	$ 38.91	17.19

PLAS0592-028 05/01/2023

ATLANTIC, CAPE MAY, CUMBERLAND AND OCEAN COUNTIES:

	Rates	Fringes
Cement mason	$ 48.96	33.97

PLAS0592-029 05/01/2023

BURLINGTON, MERCER AND MONMOUTH COUNTIES:

	Rates	Fringes
Cement mason	$ 48.96	33.97

PLAS0592-031 05/01/2023

CAMDEN, GLOUCESTER AND SALEM COUNTIES:

	Rates	Fringes
Cement mason	$ 45.32	37.61

TEAM0331-001 05/01/2023

ATLANTIC COUNTY:

	Rates	Fringes
Truck drivers:		
GROUP 2	$ 43.73	22.305
GROUP 3	$ 44.73	22.305
GROUP 4	$ 45.08	22.305
GROUP 5	$ 45.08	22.305

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous material, and when personal protective equipment is required for respiratory, skin and eye protection: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site where the worker is not working in a zone requiring Level A, B or C personal protection: $1.00 per hour additional.

PAID HOLIDAYS:
New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day.

BEREAVEMENT LEAVE:
Any worker having a death in his or her immediate family (parent, spouse, child, brother or sister, mother-in-law or father-in-law) shall be given three days time off with pay at the time of death upon furnishing proof of said death. This provision shall also apply to grandparents, when living with the worker.

DEFINITION OF GROUPS:

GROUP 2:
Truck driver, dump truck driver, water truck driver, transit mix driver, pick-up truck driver, tank truck driver, track truck driver, agitator truck driver, concrete mobile unit driver, stringer bead truck driver, Ross carrier driver, warehouse forklift driver, A-frame truck driver, gin pole truck driver, form truck driver, driver

for truck having self-loading/unloading attachment, vacuum truck/trailer driver

GROUP 3:
Tow truck driver

GROUP 4:
Trailer truck driver, winch truck driver, off-road dump truck driver, fuel truck driver, tractor trailer driver, asphalt oil distributor driver, off-road water truck driver

GROUP 5:
Mechanic

TEAM0469-002 05/01/2024

BURLINGTON COUNTY (east of a line drawn from the New Jersey Turnpike to the Delaware River); MERCER, MONMOUTH AND OCEAN COUNTIES:

	Rates	Fringes
Truck drivers:		
Group 1	$ 47.81	40.875
Group 2	$ 47.71	40.875
Group 3	$ 47.61	40.875
Group 4	$ 47.56	40.875

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous material, and when personal protective equipment is required for respiratory, skin and eye protection: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site, in a zone requiring Level A personal protection for any workers other than the truck driver: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site where the worker is not working in a zone requiring Level A, B or C personal protection: $1.00 per hour additional.

PAID HOLIDAYS:
New Year's Day, President's Day, Decoration Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day.

VACATION PAY CREDIT:
Workers working or receiving pay for 80 days within a year receive one week paid vacation (48 hours); 125 days receive two weeks paid vacation (96 hours); 145 days receive 15 days paid vacation (120 hours); 15 years seniority and 145 days receive 4 weeks paid vacation (160 hours).

DEFINITION OF GROUPS:

GROUP 1:
Drivers of the following type vehicles: dump, flat, float,

pick-up, container hauler, fuel, water sprinkler, road oil, stringer bead, hot pass, bus, dumpcrete, transit mixer, agitator mixer, half truck, winch truck, side-0-matic, dynamite, power, x-ray, welding, skid, jeep, station wagon, A-frame, all dual-purpose trucks, truck with mechanical tailgate, asphalt distributor, batch truck, seeding, mulching, fertilizing, air compressor truck (in transit), parts chaser, escort, scissor, hi-lift, telescope, concrete breaker, gin pole, stone, sand, asphalt distributor and spreader, nipper, fuel truck (driver of fuel truck, including handling of unit), skid truck (debris container - entire unit), concrete mobile truck (entire unit), expediter (parts chaser), beltcrete truck, pumpcrete truck, line truck, reel truck, wrecker, utility truck, tank truck; driver of the following type vehicles: Broyhill coal tar epoxy truck, Littleford bituminous distributor, slurry seal truck or vehicle, thiokol trackmaster pick-up (swamp cat pick-up, bucket loader dump truck and any rubber-tired tractor used in pulling and towing farm wagons and trailers of any description, or similar type vehicles); on-site repair shop; team driver; vacuum or vac-all truck (entire unit)

GROUP 2:
Driver of 3-axle trucks and floats

GROUP 3:
Driver of all Euclid-type vehicles: Euclid, International Harvester, Wabco, Caterpillar, Koehring tractor and wagon, dumptor, bottom, rear and side dump, carryall and scraper (not self-loading - loading over the top), water sprinkler, trailer, water pull and similar type of vehicle; driver of tractor and trailer-type vehicles; flat, float, I-beam, low bed, water sprinkler, bituminous transit mix, road oil, fuel bottom dump hopper, rear dump, office shanty, epoxy, asphalt, agitator mixer, mulching, stringing, seeding, fertilizing pole spread, bituminous distributor, water pull (entire unit) (tractor trailer), reel trailer and similar type of vehicle

GROUP 4:
Winch trailer driver

TEAM0676-001 05/01/2024

BURLINGTON COUNTY (west of a line drawn from the New Jersey Turnpike to the Delaware River); CAMDEN, CUMBERLAND, GLOUCESTER AND SALEM COUNTIES:

	Rates	Fringes
Truck drivers:		
GROUP 2	$ 43.30	32.37
GROUP 3	$ 43.45	32.37
GROUP 4	$ 43.65	32.37
GROUP 5	$ 43.80	32.37

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous materials, and when personal protective equipment is required for respiratory, skin and eye protection: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site, where personal protection A, B, C or D is NOT required: $1.00 per hour additional.

SHIFT WORK:
An owner mandated irregular shift staring any time other than between 6:00 am and 8:00 am to receive $1.00 per hour, for each hour worked, in addition to the regular rate of pay.

PAID HOLIDAYS:
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day (or the day after Thanksgiving, at the option of the contractor), Thanksgiving Day, the afternoon of the day before Christmas (Dec. 24) provided that the worker works in the morning, and Christmas Day, provided that the worker works or is available for work on at least two days in the week in which the holiday occurs.

BEREAVEMENT PAY:
In case of a death in the worker's immediate famiy (mother, father, wife, husband, children, brother, sister, current mother-in-law, current father-in-law, grandparents), the worker shall be allowed leave not to exceed three (3) days straight-time pay, provided that he or she shall receive no pay unless the day of death and the burial day falls on a regular work day, and not on days off, holidays, vacation, Saturdays or Sundays.

DEFINITION OF GROUPS:

GROUP 2:
Dump truck driver; water truck driver; transit mix driver; pick-up truck driver; tank truck driver; track truck driver; agitator truck driver; concrete mobile unit driver; stringer bead truck driver; tack rig driver; Ross Carrier driver; warehouse forklift driver; A-frame truck driver; gin pole truck driver; form truck driver; driver for truck having self-loading/unloading attachment; vacuum truck

GROUP 3:
Tow truck driver

GROUP 4:
Trailer truck driver; winch truck driver; off-road dump truck driver; fuel truck driver; tractor trailer driver (any trailer driver); asphalt oil distributor driver; off-road water truck driver; vacuum tractor trailer

GROUP 5:
Mechanic

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

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Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

"General Decision Number: NJ20250028 02/07/2025

Superseded General Decision Number: NJ20240028

State: New Jersey

Construction Type: Building

County: Camden County in New Jersey.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	02/07/2025

ASBE0014-004 05/01/2024

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes the application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems; also, the application of firestopping material to openings and penetrations in walls, floors, ceilings and curtain walls; also, all lead abatement)	$ 59.37	45.78

BRNJ0002-013 05/01/2021

	Rates	Fringes
Bricklayer	$ 45.20	33.26

Work on high stacks: 22% per hour additional.

BRNJ0007-012 07/04/2022

	Rates	Fringes
Marble setter	$ 62.40	38.82

BRNJ0007-014 07/01/2022

	Rates	Fringes
TERRAZZO WORKER/SETTER	$ 59.75	38.60

BRNJ0007-017 06/06/2022

	Rates	Fringes
Tile finisher	$ 42.80	28.57
Tile setter	$ 50.14	34.05

Tile finisher:
Work grouting all epoxy: $10.00 additional per day.

CARP0006-009 05/01/2024

	Rates	Fringes
CARPENTER (Scaffold Builder)	$ 56.01	59.25%+$0.14

The first sixty feet at the regular rate, 10% per hour additional for each additional fifty feet thereafter.

CARP0006-010 05/01/2024

	Rates	Fringes
CARPENTER		

Including Acoustical
Ceiling Installation,
Drywall Hanging, Formwork,
Batt and Blown Insulation...$ 56.01 59.25%+$0.14

CARP0029-006 05/01/2024

	Rates	Fringes
Soft floor layer.....	$ 56.01	59.25%+$0.14

CARP0454-009 05/01/2023

	Rates	Fringes
PILEDRIVERMAN.....	$ 46.73	41.69

PAID HOLIDAYS:
New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day; provided that the worker works any of the three days in the five-day work week preceding the holiday and the first work day after the holiday.

CARP0715-007 05/01/2020

	Rates	Fringes
Millwright.....	$ 51.58	58%+0.25

Work of erection and dismantling of elevators and towers, such as concrete conveyors and temporary material elevators, scaffolding or other structures to be used as scaffolding inside or outside of buildings: the first sixty feet at the regular rate, 10% per hour additional for each additional fifty feet thereafter.

ELEC0351-007 09/30/2024

	Rates	Fringes
Electricians: (Including Low Voltage Wiring)		
Cable splicer on lead cable.	$ 46.51	72.54% + .65
Electrician and cable splicer.....	$ 55.05	77.77%+5.95

ELEC0351-009 09/01/2024

	Rates	Fringes
ELECTRICIAN (Teledata Technicians)		
15 Voice Data Lines or Less.	$ 41.00	32.12%+19.58
16 Voice or Data Lines or more and Fiber Optics.....	$ 41.00	32.12%+19.58

ELEV0005-004 01/01/2024

	Rates	Fringes
Elevator mechanic.....	$ 68.97	37.885+a+b

A. PAID VACATION: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% for 6 months to 5 years of service.

B. Eight Paid Holidays (provided employee has worked 5 consecutive days before and the working day after the holiday): New Years's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day; Thanksgiving Day and the Friday after Thanksgiving Day, and Christmas Day.

ENGI0825-020 07/01/2024

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 60.47	36.25
GROUP 2	$ 58.88	36.25
GROUP 3	$ 56.97	36.25
GROUP 4	$ 55.34	36.25
GROUP 5	$ 51.63	36.25

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous material, and when personal protective equipment is required for respiratory, skin and eye protection: 20% per hour additional.

PAID HOLIDAYS:
New Year's Day, Washington's Birthday observed, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day; provided 1) that the worker works three of the preceding five work days before the holiday; or, the work day before the holiday and the work day after the holiday; and, 2) that the worker works the work day before and the work day after the holiday.

DEFINITION OF GROUPS:

GROUP 1:
Backhoe, Including Backhoe Track; Boom; Concrete Paving Machine; Crane (all types, including overhead and straddle traveling type); Drill (down-the-hole drill, rotary drill, self-propelled hydraulic drill, self-powered drill); Elevating Grader; Excavator; Front End Loader (5 cu. yd. and over); Piledriver (length of boom, including length of leads, shall determine premium rate applicable); Trencher

GROUP 2:
Backhoe Loader Combo; Concrete Pumper; Grader/Blade (Finish); Hoist; Hydraulic Crane, 10 Tons and under; Front End Loader (2 cu. yd. but less than 5 cu. yd.); Scraper; Side Boom

GROUP 3:
Asphalt Spreader; Bulldozer;Compressor(2 or 3) (in Battery) (within 100 ft.); Forklift; Front End Loader (1 cu. yd. and over but less than 2 cu. yd.); Lull; Mechanic; Paver, Asphalt; Roller, Blacktop; Tractor;

GROUP 4:

Bobcat/Skid Loader; Compressor (Single); Farm Tractor; Front End Loader (under 1 cu. yd.); Hydroseeder; Roller, Grade; Pump, Hydraulic

GROUP 5:
Oiler

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* IRON0399-007 07/01/2024

	Rates	Fringes
IRONWORKER (Reinforcing)	$ 53.24	38.40
IRONWORKER (Structural and Ornamental)	$ 54.24	38.40

LABO0008-001 05/01/2011

	Rates	Fringes
Asbestos Removal Laborer	$ 28.37	21.62

The removal, abatement, enclosure and decontamination of personal protective equipment, chemical protective clothing and machinery relating to asbestos and/or toxic and hazardous waste or materials which shall include but not necessarily be limited to: the erection, moving, servicing and dismantling of all enclosures, scaffolding and barricades; the operation of all tools and equipment normally used in the removal or abatement of asbestos and toxic or hazardous waste or materials; the labeling, bagging, cartoning, crating, or other packaging of materials for disposal; the clean-up of the worksite; and all other work incidental to the removal, abatement, encapsulation, enclosure, and decontamination of asbestos and toxic or hazardous waste or materials; and, in addition, all work tasks involved in the maintenance and operation of energy resource recovery plants (co-generation plants)

LABO0077-002 05/01/2022

	Rates	Fringes
LABORER		
MASON TENDER:		
Brick/Cement/Concrete	$ 36.50	30.22

LABO0077-005 05/01/2022

	Rates	Fringes
Laborers:		
Asphalt Shoveler, Asphalt Spreader, Common or General Laborer, Landscape Laborer, Pipelayer, Power Tool Operator and Screedman	$ 35.75	30.22

PAIN0711-018 05/01/2024

	Rates	Fringes

DRYWALL FINISHER/TAPER.....$ 43.41 29.86

PAIN0711-019 05/01/2017

	Rates	Fringes
PAINTER (Brush & Roller).....	$ 39.25	22.66
PAINTER (Spray).....	$ 40.28	19.98

PLAS0592-035 05/01/2023

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 45.32	37.61

PLUM0322-009 05/01/2024

	Rates	Fringes
PIPEFITTER (Including HVAC Pipe Installation).....	$ 50.60	52.71
PLUMBER (Excluding HVAC Pipe Installation).....	$ 50.60	52.71

ROOF0030-027 05/01/2024

	Rates	Fringes
Roofer		
SHINGLES.....	$ 34.35	21.85
SLATE AND TILE.....	$ 37.35	21.85
ALL OTHER WORK.....	$ 44.13	34.33

Mopper, and operator of felt-laying machine: $.50 per hour additional.

Work applying roofing material, on any new construction job, on those days on which a felt-laying machine or slag dispensing machine is used: $.50 per hour additional.

PAID HOLIDAY:
The last working day before Christmas, to be paid at the rate of four hours pay.

SFNJ0692-003 05/01/2021

	Rates	Fringes
Sprinkler fitter (Fire Sprinklers).....	$ 60.83	30.34

SHEE0019-018 07/17/2021

	Rates	Fringes
Sheet metal worker (Including HVAC Duct Installation).....	$ 53.84	44.44
SHEET METAL WORKER (Sign Makers & Hangers).....	$ 29.49	23.90

Paid Holiday:
Election Day.

TEAM0676-003 05/01/2024

	Rates	Fringes
Truck drivers:		
Dump Truck Drivers	$ 43.30	32.3711
Off the Road Truck	$ 43.65	32.3711

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous materials, and when personal protective equipment is required for respiratory, skin and eye protection: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site, where personal protection A, B, C or D is NOT required: $1.00 per hour additional.

SHIFT WORK:
An owner mandated irregular shift staring any time other than between 6:00 am and 8:00 am to receive $1.00 per hour, for each hour worked, in addition to the regular rate of pay.

PAID HOLIDAYS:
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day (or the day after Thanksgiving, at the option of the contractor), Thanksgiving Day, the afternoon of the day before Christmas (Dec. 24) provided that the worker works in the morning, and Christmas Day, provided that the worker works or is available for work on at least two days in the week in which the holiday occurs.

BEREAVEMENT PAY:
In case of a death in the worker's immediate famiy (mother, father, wife, husband, children, brother, sister, current mother-in-law, current father-in-law, grandparents), the worker shall be allowed leave not to exceed three (3) days straight-time pay, provided that he or she shall receive no pay unless the day of death and the burial day falls on a regular work day, and not on days off, holidays, vacation, Saturdays or Sundays.

SUNJ2004-004 01/02/2009

	Rates	Fringes
GLAZIER	$ 30.82	15.60
PLASTERER	$ 42.33	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide

employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

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A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the

collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
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Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as

conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

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Wage and Hour Division
U.S. Department of Labor
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2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

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The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

"General Decision Number: NJ20250049 02/14/2025

Superseded General Decision Number: NJ20240049

State: New Jersey

Construction Type: Heavy

County: Camden County in New Jersey.

HEAVY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	02/07/2025
2	02/14/2025

ASBE0014-004 05/01/2024

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes the application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems; also, the application of firestopping material to openings and penetrations in walls, floors, ceilings and curtain walls; also, all lead abatement)	$ 59.37	45.78

CARP0006-009 05/01/2024

	Rates	Fringes
CARPENTER (Scaffold Builder)	$ 56.01	59.25%+$0.14

The first sixty feet at the regular rate, 10% per hour additional for each additional fifty feet thereafter.

CARP0006-013 05/01/2024

	Rates	Fringes
CARPENTER (Including Form Work)	$ 56.01	59.25%+$0.14

The first sixty feet at the regular rate, 10% per hour additional for each additional fifty feet thereafter.

CARP0454-009 05/01/2023

	Rates	Fringes
PILEDRIVERMAN	$ 46.73	41.69

PAID HOLIDAYS:
New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day; provided that the worker works any of the three days in the five-day work week preceding the holiday and the first work day after the holiday.

CARP0715-007 05/01/2020

	Rates	Fringes
Millwright	$ 51.58	58%+0.25

Work of erection and dismantling of elevators and towers, such as concrete conveyors and temporary material elevators, scaffolding or other structures to be used as scaffolding inside or outside of buildings: the first sixty feet at the regular rate, 10% per hour additional for each

additional fifty feet thereafter.

ELEC0351-013 09/30/2024

	Rates	Fringes
Electricians:		
Cable splicer on lead cable.	$ 46.51	72.54% + .65
Electrician and cable splicer	$ 55.05	77.77%+5.95

ENGI0825-021 07/01/2024

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 60.47	36.25
GROUP 2	$ 58.88	36.25
GROUP 3	$ 56.97	36.25
GROUP 4	$ 55.34	36.25
GROUP 5	$ 51.63	36.25

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous material, and when personal protective equipment is required for respiratory, skin and eye protection: 20% per hour additional.

PAID HOLIDAYS:
New Year's Day, Washington's Birthday observed, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day, Thanksgiving Day and Christmas Day; provided 1) that the worker works three of the preceding five work days before the holiday; or, the work day before the holiday and the work day after the holiday; and, 2) that the worker works the work day before and the work day after the holiday.

DEFINITION OF GROUPS:

GROUP 1:
Backhoe, Including Backhoe Track; Boom; Concrete Paving Machine; Crane (all types, including overhead and straddle traveling type); Drill (down-the-hole drill, rotary drill, self-propelled hydraulic drill, self-powered drill); Elevating Grader; Excavator; Front End Loader (5 cu. yd. and over); Piledriver (length of boom, including length of leads, shall determine premium rate applicable)

GROUP 2:
Backhoe Loader Combo; Concrete Pumper; Grader/Blade (Finish); Hoist; Hydraulic Crane, 10 Tons and under; Front End Loader (2 cu. yd. but less than 5 cu. yd.); Scraper; Side Boom

GROUP 3:
Asphalt Spreader; Bulldozer; Compressor(2 or 3) (in Battery) (within 100 ft.); Crusher; Forklift; Front End Loader (1 cu. yd. and over but less than 2 cu. yd.); Lull; Mechanic; Paver, Asphalt; Roller, Blacktop; Tractor;

GROUP 4:
  Broom; Compressor (Single); Farm Tractor; Front End Loader
  (under 1 cu. yd.); Roller, Grade; Pump

GROUP 5:
  Oiler

IRON0399-007 07/01/2024

	Rates	Fringes
IRONWORKER (Reinforcing)	$ 53.24	38.40
IRONWORKER (Structural and Ornamental)	$ 54.24	38.40

LABO0077-008 07/01/2012

	Rates	Fringes
LABORER		
MASON TENDER:		
Cement/Concrete	$ 29.35	23.07

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* LABO0172-009 03/01/2024

	Rates	Fringes
Laborers:		
Common or General Laborer; Landscape Laborer, Power Tool Operator	$ 49.30	36.73
Pipelayer	$ 50.00	36.73

Hazardous waste removal work:
  Work on a state or federally designated hazardous waste
  site, where the worker is required to wear Level A, B or C
  personal protection: $3.00 per hour additional.

  Work on a state or federally designated hazardous waste
  site, where the worker is not required to wear Level A, B,
  or C personal protection: $1.00 per hour additional.

PAID HOLIDAYS:
  New Year's Day, President's Day, Memorial Day,
  Independence Day, Labor Day, Presidential Election Day,
  Veteran's Day, Thanksgiving Day and Christmas Day; provided
  that the worker works three days for the same employer
  within a period of ten working days consisting of five
  working days before and five working days after the day
  upon which the holiday falls or is observed.

PAIN0711-023 05/01/2023

	Rates	Fringes
Painters:		
Work on bridges (Major Bridges Designed for Commercial Navigation)	$ 58.28	33.85

PAIN0711-024 05/01/2017

	Rates	Fringes
Painters:		
New Construction		
Brush and roller	$ 40.19	22.72
Repaint work, on projects on which no major alterations occur.		
Brush and roller	$ 29.05	18.91

PLAS0592-035 05/01/2023

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 45.32	37.61

PLUM0322-010 05/01/2024

	Rates	Fringes
PIPEFITTER	$ 50.60	52.71

TEAM0676-005 05/01/2024

	Rates	Fringes
Truck drivers:		
Dump Truck Drivers; Pickup Truck	$ 43.30	32.3711
Off the Road Truck; Flatbed Truck	$ 43.65	32.3711

Hazardous waste removal work:
Work on a state or federally designated hazardous waste site, where the worker is in direct contact with hazardous materials, and when personal protective equipment is required for respiratory, skin and eye protection: $3.00 per hour additional.

Work on a state or federally designated hazardous waste site, where personal protection A, B, C or D is NOT required: $1.00 per hour additional.

SHIFT WORK:
An owner mandated irregular shift staring any time other than between 6:00 am and 8:00 am to receive $1.00 per hour, for each hour worked, in addition to the regular rate of pay.

PAID HOLIDAYS:
New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Presidential Election Day, Veteran's Day (or the day after Thanksgiving, at the option of the contractor), Thanksgiving Day, the afternoon of the day before Christmas (Dec. 24) provided that the worker works in the morning, and Christmas Day, provided that the worker works or is available for work on at least two days in the week in which the holiday occurs.

BEREAVEMENT PAY:
In case of a death in the worker's immediate famiy (mother, father, wife, husband, children, brother, sister, current mother-in-law, current father-in-law, grandparents), the worker shall be allowed leave not to exceed three (3) days straight-time pay, provided that he or she shall receive no

pay unless the day of death and the burial day falls on a regular work day, and not on days off, holidays, vacation, Saturdays or Sundays.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the

classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on

a wage determination matter
d) an initial conformance (additional classification
and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"