NOTICE TO BIDDERS Notice is hereby given that sealed proposals will be received by the Municipal Clerk, Borough of Stone Harbor, Cape May County, New Jersey for the 82nd Street Recreation Facility Tennis Court Building opened and read in public at the Borough of Stone Harbor Municipal Building, 9508 Second Avenue, Stone Harbor, Cape May County, New Jersey on July 11, 2018 at 1:30 p.m. prevailing time. Bid Documents and Drawings for the proposed work, which have been prepared by DeBlasio & Associates, P.C., are available at the office of said Engineer at 4701 New Jersey Avenue, Wildwood, New Jersey 08260, and may be inspected by prospective bidders during business hours. Bidders will be furnished with a copy of the Bid Documents by request upon proper notice and payment of a non-refundable charge of $50.00 payable to DeBlasio & Associates, P.C., for reproduction and processing. Proposals must be made on the standard Proposal Forms in the manner designated in the Bid Documents, must be enclosed in sealed envelopes bearing the name and address of the Bidder, and the name of the work on the outside addressed to Clerk, Borough of Stone Harbor; and must be accompanied by a statement of Consent of Surety from a surety company authorized to do business in the State of New Jersey and acceptable to the Borough and either a Bid Bond, Certified or Cashier's Check drawn to the order of the Borough of Stone Harbor for not less than ten percent (10%) of the amount bid, except that the check need not exceed $20,000.00. The successful bidder is hereby notified that a performance bond for the full amount of the project is required. The successful bidder will be required to execute a contract for the performance of the said work or the furnishing of said material or both, as the case may be, and a surety bond to be executed by a reliable surety company in a sum equal to the amount of the contract price for said work and/or material, guaranteeing the performance of the contract, which surety bond and contract shall be approved as to form and execution by the Borough Solicitor. The bidders shall also be required to comply with the following: A. Affirmative Action requirements (N.J.S.A. 10:5-31 et. seq.and N.J.A.C. 17:27). B.Certification Pursuant to P.L. 2012, C.25 (no investment activities in Iranian financial or energy sectors). C. The provisions of the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et. seq). D. Americans with Disability Act of 1990, Title II (42 U.S.C. S121 01). E. Worker and Community Right-to-Know Act (N.J.S.A. 34:5A-1). F. Stockholder Disclosure Certifica-tion (P.L. 1977, C.33, N.J.S.A. 52:25-24.2). G. Business Registration Certification (N.J.S.A. 52:32-44). H. Public Works Contractors Registra-tion (N.J.S.A. 34:11-56.48). I. Consent of Surety (N.J.S.A. 40A:11-22). J.Addendum Acknowledgement (N.J.S.A. 40A:11-23c. 1), 2) &3). K. Subcontractors List (N.J.S.A. 40A:11-16). The award of the contract for this project will not be made until the necessary funds have been provided by the Borough of Stone Harbor in a lawful manner. The Borough of Stone Harbor reserves the right to consider the bids for sixty (60) days after the receipt of said bids. The Borough of Stone Harbor also reserves the right to reject any or all bids or to waive any informalities in the best interest of the Borough of Stone Harbor. Each proposal and bid must be submitted in accordance with the terms of the aforesaid specifications, must be made on standard proposal forms contained in the bid documents and shall be delivered to the place and hour mentioned above. BY ORDER OF the Borough of Stone Harbor, Cape May County, New Jersey. Suzanne Stanford, Municipal Clerk Dated: June 26, 2018 Printer Fee: $53.34 #0000083587 Pub Date: June 26, 2018

PROPOSAL SECTION

BID DOCUMENT CHECKLIST

Borough of Stone Harbor, Cape May County, New Jersey

82nd Street Recreation Facility Tennis Court Building: D&A File # SH-C-005

Required by Owner	Submission Requirement	Statutory Reference	Initial each required entry and if required submit the item
☒	Stockholder Disclosure Certification*	N.J.S.A. 52:25-24.2	
☒	Bid Guarantee* (with Power of Attorney for full amount of *Bid* Bond)	N.J.S.A. 40A:11-21	
☒	Consent of Surety* (with Power of Attorney for full amount of Bid Price)	N.J.S.A. 40A:11-22	
☒	Acknowledgement of Receipt of Addenda*	N.J.S.A. 40A:11-23 c.1),2),3)	
☒	Subcontractors List*	N.J.S.A. 40A:11-16	
☒	Equipment Certification	N.J.S.A. 40A:11-20	
☒	Non-Collusion Affidavit	N.J.S.A. 52:34-15	
☒	Public Works Contractor Registration Form	N.J.S.A. 34A:11-56.48	
☒	Background Questionnaire and References	N.J.S.A. 40A:11-23.1b.	
☒	Mandatory Affirmative Action Language Compliance Notice	N.J.S.A. 10:5-31	

☒	Disclosure of Investment Activities in Iran	N.J.S.A. 40A:11-23.1b.	
☒	Status of Present Contracts	N.J.S.A. 40A:11-23.1b.	
☒	Business Registration Certification	N.J.S.A. 52:32-44	
☒	Bid Proposal Form	N.J.S.A. 40A:11-23.1b.	

**Failure to submit any one of these mandatory items shall be deemed a fatal defect that shall render the bid proposal unresponsive and that cannot be cured by the Owner (N.J.S.A. 40A:11-23.2.).*

The undersigned hereby acknowledges and submits the above listed items.

Name of Bidder: _____

Name of Authorized Representative: _____

Title of Authorized Representative: _____

Signature: _____

Date: _____

Company Name: _____

Mailing Address: _____

Phone Number: _____

Fax Number: _____

Email Address: _____

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	Home Address (for Individuals) or Business 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	Home Address (for Individuals) or Business 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 ***Owner*** 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 the ***Owner*** to notify the ***Owner*** 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 ***Owner*** to declare any contract(s) resulting from this certification void and unenforceable.

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

BID GUARANTEE

A person bidding on a contract for the erection, alteration or repair of a public building, structure, facility or other improvement to real property, the total price of which exceeds $100,000, shall furnish a guarantee as provided for herein.

The guarantee shall be payable to the Owner so that if the contract is awarded to the bidder, the bidder will enter into a contract therefor and will furnish any performance bond or other security required as a guarantee or indemnification.

The guarantee shall be in the amount of 10% of the bid, but not in excess of $20,000.00, except as otherwise provided herein, and may be given, at the option of the bidder, by certified check, cashier's check or bid bond. In the event that any law or regulation of the United States imposes any condition upon the awarding of a monetary grant to any Owner, which condition requires the depositing of a guarantee in an amount other than 10% of the bid or in excess of $20,000.00 the provisions of this section shall not apply and the requirements of the law or regulation of the United States shall govern.

CONSENT OF SURETY

A performance bond will be required from the successful contractor on this project, and consequently, all bidders shall submit, with their bid, a consent of surety in substantially the following form:

To: _____
(Owner)

Re: _____
(Contractor)

_____
(Project Description)

This is to certify that the

_____
(Surety Company)

will provide to _____ a performance bond in
(Owner)
the full amount of awarded contract in the event that said contractor is awarded a contract for the above project.

_____
(CONTRACTOR)

_____
(Authorized Agent of Surety Company)

Date: _____

CONSENT OF SURETY MUST BE SIGNED BY AN AUTHORIZED AGENT OR REPRESENTATIVE OF A SURETY COMPANY AND NOT BY THE INDIVIDUAL OR COMPANY REPRESENTATIVE SUBMITTING THE BID

Borough of Stone Harbor, Cape May County, New Jersey
82nd Street Recreation Facility Tennis Court Building: D&A File #SH-C-005

ACKNOWLEDGMENT OF RECEIPT OF ADDENDA

The undersigned Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Dated	Acknowledge Receipt (initial)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

☐ **No addenda were received:**

Acknowledged for: _____
(Name of Bidder)

By: _____
(Signature of Authorized Representative)

Name: _____
(Print or Type)

Title: _____

Date: _____

SUBCONTRACTORS LIST

In accordance with N.J.S.A. 40A:11-16, the bidder shall be set forth in the bid the name or names of all subcontractors to whom the general contractor will subcontract for branches of work in the following categories:

(1) The plumbing and gas fitting and all kindred work;
(2) Steam power plants, steam and hot water heating and ventilating and refrigeration apparatus and all kindred work;
(3) Electrical work, including any electrical power plants, tele-data, fire alarm, or security system;
(4) Structural steel and ornamental iron work;

Whenever a bid sets forth more than one subcontractor for any of the categories (1) through (4) listed above, the bidder shall submit to the Owner 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 Owner 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 Owner, the Owner shall award the contract to the next lowest responsible bidder.

The Owner shall require evidence of performance security to be submitted simultaneously with the bid. Evidence of performance security may be supplied by the bidder on behalf of himself and any or all subcontractors, or by each respective subcontractor, or by any combination thereof which results in evidence of performance security equaling, but in no event exceeding, the total amount bid.

If the work of the types of the branches listed above will be performed by the bidder and will not be provided by a subcontractor, then the bidder shall indicate **"To Be Performed by Bidder"** below. In this case the bidder shall list the employees name and the applicable licenses covering these trade categories.

If the work of the types of the branches listed above are not involved in this contract, then the bidder shall indicate **"Not Applicable"**.

(1) The plumbing and gas fitting and all kindred work;

Indicate if the bidder intends to use a subcontractor or if the work will be performed by the bidder: _____

Name: _____

Address: _____

License Number: _____

(2) Steam power plants, steam and hot water heating and ventilating and refrigeration apparatus and all kindred work;

Indicate if the bidder intends to use a subcontractor or if the work will be performed by the bidder: _____

Name: _____

Address: _____

License Number: _____

(3) Electrical work, including any electrical power plants, tele-data, fire alarm, or security system;

Indicate if the bidder intends to use a subcontractor or if the work will be performed by the bidder: _____

Name: _____

Address: _____

License Number: _____

(4) Structural steel and ornamental iron work;

Indicate if the bidder intends to use a subcontractor or if the work will be performed by the bidder: _____

Name: _____

Address: _____

License Number: _____

EQUIPMENT CERTIFICATION

The undersigned Bidder hereby certifies as follows:

The bidder owns or controls all the necessary equipment required to accomplish the work described in the specifications.

Name of Bidder: _____

By: _____
(Signature)

Name of above: _____
(Print)

Title: _____

Date: _____

NON-COLLUSION AFFIDAVIT

State of New Jersey

County of _____ ss:

I, _____ residing in _____
(name of affiant) (name of municipality)
in the County of _____ and State of _____of
full age, being duly sworn according to law on my oath depose and say that:

I am _____ of the firm of _____
(title or position) (name of firm)

_____ the bidder making this Proposal for the bid

entitled _____, and that I executed the said proposal with
(title of bid proposal)
full authority to do so that said bidder has not, directly or indirectly entered into any agreement, 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
(name of Owner)
statements contained in said Proposal and in the statements contained in this affidavit in awarding the contract for the said project.

I further warrant that no person 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 _____.

Subscribed and sworn to

before me this day _____
Signature

_____, 2____ _____
(Type or print name of affiant under signature)

_____
Notary public of
My Commission expires _____
(Seal)

PUBLIC WORKS CONTRACTOR REGISTRATION FORM

The Public Works Contractor Registration Act (PWCRA) requires that all contractors, including named subcontractors, to register with the Department of Labor prior to submitting price proposals or engaging on certain public works contracts that exceed the prevailing wage threshold.

Under the law a *contractor* is 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.]. It applies to contractors based in New Jersey or in another state.

The PWCRA defines "public works projects" as contracts for "public work" as defined in the Prevailing Wage Act [N.J.S.A. 34:11-56.26(5)]. The term means:

- "Construction, reconstruction, demolition, alteration, or repair work, or maintenance work, including painting and decorating, done under contract and paid for in whole or in part out of the funds of a public body, except work performed under a rehabilitation program.
- "Public work" shall also mean construction, reconstruction, demolition, alteration, or repair work, done on any property or premises, whether or not the work is paid for from public funds,..."
- "Maintenance work" means the repair of existing facilities when the size, type or extent of such facilities is not thereby changed or increased. While "maintenance" includes painting and decorating and is covered under the law, it does not include work such as routine landscape maintenance or janitorial services.

In order to provide guidance to the Owner on implementing the law, the following have been identified in the law:

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. 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)
3. After bid proposals are received, and prior to contract award, the contractor most likely to receive the contract award must submit to the public entity copies of certifications of all listed sub-contractors.
4. The Owner must review the certificates to be sure they were in effect at the time the bid proposals were received.
5. Non-listed subcontractors do not have to be registered until they physically start the public work assigned to them.

6. Bid proposal documents need to inform those submitting proposals of these requirements.

Name	**Registration Number**
Bidder: _____	_____
Subcontractor: _____	_____
Subcontractor: _____	_____
Subcontractor: _____	_____
Subcontractor: _____	_____

BACKGROUND REFERENCES AND QUESTIONNAIRE

1. General Identification

Business Entity Name (the "Company") _____

D/B/A ("Doing Business As"), if any_____

Street Address_____

City/State/Zip_____

Phone No._____Fax No. _____

Email: _____

2. Business Organization and History

Type of Business Entity: _____

List the Partners and Officers Below:

Partner / Officer Name	% of Ownership

Date the Company was formed or incorporated_____

State in which the Company was formed or incorporated _____

How many years' experience has the Company had regarding the proposed work in the contract? _____

Has the Company failed to complete any work within the last five years? If so, please list the project, there location and an explanation.

_____

_____

Has the Company or any of its AFFILIATE FIRMS ever been the subject of any of the following actions by any government agency (Note: Matters under appeal must be disclosed.):

a) been suspended, debarred, disqualified, declared non-responsible, or had its prequalification revoked?
   - ☐ No
   - ☐ Yes

b) been prevented, or barred, or agreed to a voluntary exclusion, from bidding/contracting for any integrity related reason?
   - ☐ No
   - ☐ Yes

c) been denied a contract despite being the low bidder for any integrity related reason?
   - ☐ No
   - ☐ Yes

d) had a contract terminated for "cause"?
   - ☐ No
   - ☐ Yes

List the projects your company has completed in the last three (3) years:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

7. _____

8. _____

9. _____

10. _____

**Attach additional sheets if necessary.*

3. References

Please list the names, addresses and telephone numbers of references for the projects listed above:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

**Attach additional sheets if necessary.*

AFFIRMATIVE ACTION COMPLIANCE NOTICE

This form is a summary of the successful bidder's requirement to comply with the requirements of N.J.S.A. 10:5-31 and N.J.A.C. 17:27-1 et seq.

The successful bidder shall submit to the public agency, after notification of award but prior to execution of this contract, one of the following three documents as forms of evidence:

(a) A photocopy of a valid letter that the contractor is operating under an existing Federally approved or sanctioned affirmative action program (good for one year from the date of the letter);

OR

(b) A photocopy of a Certificate of Employee Information Report approval, issued in accordance with N.J.A.C. 17:27-4;

OR

(c) A photocopy of an Employee Information Report (Form AA302) provided by the Division and distributed to the public agency to be completed by the contractor in accordance with N.J.A.C. 17:27-4.

The successful vendor may obtain the Affirmative Action Employee Information Report (AA302) from the contracting unit during normal business hours.

The successful vendor(s) must submit the copies of the AA302 Report to the Division of Contract Compliance and Equal Employment Opportunity in Public Contracts (Division). The Public Agency copy is submitted to the public agency, and the vendor copy is retained by the vendor.

The undersigned vendor certifies that he/she is aware of the commitment to comply with the requirements of N.J.S.A. 10:5-31 and N.J.A.C. 17:27.1 et seq. and agrees to furnish the required forms of evidence.

The undersigned vendor further understands that his/her bid may be rejected as non-responsive if said contractor fails to comply with the requirements of N.J.S.A. 10:5-31 and N.J.A.C. 17:27-1 et seq.

COMPANY: _____

SIGNATURE: _____

PRINT NAME: _____ TITLE: _____

DATE: _____

DISCLOSURE OF INVESTMENTS IN IRAN

PART 1 CERTIFICATION

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that neither the person nor entity, nor any of its parents, subsidiaries, or affiliates, is identified on the Department of the Treasury's Chapter 25 list as a person or entity engaged in investment activities in Iran. The Chapter 25 list is found on the Division's website at http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf. Vendors/Bidders must review this list prior to completing the below certification. Failure to complete the certification will render a Vendor's/Bidder's proposal non-responsive. If the Director of the Division of Purchase and Property finds a person or entity to be in violation of the law, s/he shall take action as may be appropriate and 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.

CHECK THE APPROPRIATE BOX:

☐ A. I certify, pursuant to Public Law 2012, c. 25, that neither the Vendor/Bidder listed above nor any of its parents, subsidiaries, or affiliates is listed on the N.J. Department of the Treasury's list of entities determined to be engaged in prohibited activities in Iran pursuant to P.L. 2012, c. 25 ("Chapter 25 List"). Disregard Part 2 and complete and sign the Certification below. OR

☐ B. I am unable to certify as above because the Vendor/Bidder and/or one or more of its parents, subsidiaries, or affiliates is listed on the Department's Chapter 25 list. I will provide a detailed, accurate and precise description of the activities in Part 2 below and sign and complete the Certification below. Failure to provide such information will result in the proposal being rendered as nonresponsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.

PART 2

PLEASE PROVIDE ADDITIONAL INFORMATION RELATED TO INVESTMENT ACTIVITIES IN IRAN If you checked Box "B" above, provide a detailed, accurate and precise description of the activities of the Vendor/Bidder, or one of its parents, subsidiaries or affiliates, engaged in the investment activities in Iran by completing the boxes below.

ENTITY NAME: _____

RELATIONSHIP TO VENDOR/BIDDER: _____

DESCRIPTION OF ACTIVITIES: _____

DURATION OF ENGAGEMENT: _____

ANTICIPATED CESSATION DATE: _____

VENDOR/BIDDER CONTACT NAME: _____

VENDOR/BIDDER CONTACT PHONE No.: _____

Attach Additional Sheets If Necessary.

CERTIFICATION I, the undersigned, certify that I am authorized to execute this certification on behalf of the Vendor/Bidder, that the foregoing information and any attachments hereto, to the best of my knowledge are true and complete. I acknowledge that the State of New Jersey is relying on the information contained herein, and that the Vendor/Bidder is under a continuing obligation from the date of this certification through the completion of any contract(s) with the State to notify the State 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. If I do so, I will be subject to criminal prosecution under the law, and it will constitute a material breach of my agreement(s) with the State, permitting the State to declare any contract(s) resulting from this certification void and unenforceable.

Signature: _____ Date: _____

Print Name and Title: _____

STATUS OF PRESENT CONTRACTS

The undersigned Bidder hereby certifies as follows:

The bidder currently has the following uncompleted contracts at the time of submission of this bid:

Name of Contract and Contracting Entity	Amount of Contract
1.	
2.	
3.	
4.	
5.	
6.	

Please attach additional sheets if more space is needed.

Name of Bidder: _____

By: _____
(Signature)

Name of Above: _____
(Print)

Title: _____

Date: _____

BUSINESS REGISTRATION CERTIFICATION

In accordance with N.J.S.A. 52:32-44, Business Organizations are required to be registered with the New Jersey Department of Treasury, Division of Revenue.

Definitions relative to registration of certain businesses; registration requirements.

1. a. For the purposes of this section:

"Business organization" means an individual, partnership, association, joint stock company, trust, corporation, or other legal business entity or successor thereof;

"Business registration" means a business registration certificate issued by the Department of the Treasury or such other form or verification that a contractor or subcontractor is registered with the Department of the Treasury;

"Contractor" means a business organization that seeks to enter, or has entered into, a contract to provide goods or services or to construct a construction project with a contracting agency;

"Contracting agency" means the principal departments in the Executive Branch of the State Government, and any division, board, bureau, office, commission or other instrumentality within or created by such department, or any independent State authority, commission, instrumentality or agency, or any State college or university, any county college, or any local unit;

"Local unit" means any contracting unit as defined pursuant to section 2 of P.L.1971, c.198 (C.40A:11-2), any board of education as defined pursuant to N.J.S.18A:18A-2, a private firm that has entered into a contract with a public entity for the provision of water supply services pursuant to P.L.1995, c.101 (C.58:26-19 et al.), a private firm or public authority that has entered into a contract with a public entity for the provision of wastewater treatment service pursuant to P.L.1995, c.216 (C.58:27-19 et al.), and a duly incorporated nonprofit association that entered into a contract with the governing body of a city of the first class for the provision of wastewater treatment services pursuant to P.L.1995, c.216 (C.58:27-19 et al.);

"Subcontractor" means any business organization that is not a contractor that knowingly provides goods or performs services for a contractor or another subcontractor in the fulfillment of a contract issued by a contracting agency.

b. No contract shall be entered into by any contracting agency unless the contractor provides a copy of its business registration in accordance with the following schedule:

(1) In response to a request for bids or a request for proposals, at the time a bid or proposal is submitted; or

(2) For all other transactions, before the issuance of a purchase order or other contracting document. In its sole discretion, the contracting unit may waive this requirement if a business registration has been previously provided to the contracting agency.

c. A subcontractor shall provide a copy of its business registration to any contractor who shall forward it to the contracting agency. No contract with a subcontractor shall be entered into by any contractor under any contract with a contracting agency unless the subcontractor first provides proof of valid business registration. The contracting agency shall file all business registrations received by the contracting agency with other procurement documents related to the contract.

d. A contract entered into by a contracting agency with a contractor shall include provisions under subsection b. of this section and this subsection for the contractor to comply with, and for the contractor to notify subcontractors by written notice to comply with subsection c. of this section. A contracting agency shall not be responsible for a contractor's failure to comply with this section. 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 during the course of the contract performance. A complete and accurate list shall be submitted before final payment is made for goods provided or services rendered or for construction of a construction project under the contract.

e. Notice of the provisions of this section shall be included by the contracting agency in any bid specification, requests for proposals, or other documents notifying potential contractors of opportunities to provide goods or perform services for a contracting agency.

f. Nothing in this section shall in any way alter the provisions or change the responsibilities or obligations of casino industry licensees as set forth in section 92 of P.L.1977, c.110 (C.5:12-92).

g. (1) A contractor or a contractor with a subcontractor that has entered into a contract with a contracting agency, 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," P.L.1966, c.30 (C.54:32B-1 et seq.) on all their sales of tangible personal property delivered into this State.

(2) A contracting agency entering into a contract with a contractor, or a contractor with a subcontractor, shall include in its contract to provide goods or perform services or to construct a construction project with that contractor, or a contractor with a subcontractor, for the term of the contract, a requirement that the contractor or subcontractor 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," P.L.1966, c.30 (C.54:32B-1 et seq.) on all their sales of tangible personal property delivered into this State.

(3) For the purposes of this subsection, "affiliate" means any entity that (1) directly, indirectly, or constructively controls another entity, (2) is directly, indirectly, or constructively controlled by another entity, or (3) is subject to the control of a common entity. For purposes of this subsection an entity controls another entity if it owns, directly or individually, more than 50% of the ownership interest in that entity.

Name	Not Registered	Registration Number
1. Bidder: _____	_____	_____
2. Subcontractor: _____	_____	_____
3. Subcontractor: _____	_____	_____
4. Subcontractor: _____	_____	_____
5. Subcontractor: _____	_____	_____

Subscribed and sworn to
before me this day _____, 2_____

_____
Signature

_____
(Type or print name of affiant under signature)

Notary public of My Commission expires _____
(Seal)

BID FORM

The UNDERSIGNED, as bidder, declares that the only persons or parties interested in this proposal as principals are named herein; that this proposal is in all respects fair and without collusion or fraud; that no officer or employee of the Owner is directly or indirectly interested in this bid or the work of this contract or in any portions of the profits thereof; that he/she has carefully examined the annexed proposed Bid Documents and Instructions to Bidders, the Notice to Bidders, the Special Provisions, and the General Requirements; that he/she or his/her representative has made a personal inspection of the site of the proposed work; and that he/she proposes and agrees that if this proposal is accepted, he/she will contract with the **Borough of Stone Harbor**, in the form of contract hereto annexed, and to provide the necessary machinery, tools, apparatus, and other means of construction, and to furnish all the materials, equipment and labor specified in the contract in the manner and time therein specified, and according to the requirements of the Engineer as therein specified, and according to the requirements of the Engineer as therein set forth, and that he will take in full payment therefore the following prices:

Contract Completion Time: **75 Calendar Days**

BOROUGH OF STONE HARBOR
82ND STREET RECREATION FACILITY TENNIS COURT BUILDING

Item	Quantity	Units	Description	Unit Price	Amount
1	Lump Sum	Lump Sum	Site Improvements: Price includes all work included in Sections 02100, 02120, 02130, 02140, 02200, 02220, 02240, 02290, 02315, 02622, 02627, 02710, 02811, and as detailed in the construction documents.	$	$
2	Lump Sum	Lump Sum	Concrete (Division 3): Price includes all work included in Section 033000, and as detailed in the construction documents.	$	$
3	Lump Sum	Lump Sum	Masonry (Division 4): Price includes all work included in Sections 042200, 044313.16, 047200, and as detailed in the construction documents.	$	$
4	Lump Sum	Lump Sum	Wood, Plastics, and Composites (Division 6): Price includes all work included in Sections 061000, 061533, 061600, 062013, 064600, and as detailed in the construction documents.	$	$
5	Lump Sum	Lump Sum	Thermal and Moisture Protection (Division 7): Price includes all work included in Sections 071416, 072100, 072500 and 074600, 076200, 077100, 079200, and as detailed in the construction documents.	$	$
6	Lump Sum	Lump Sum	Openings (Division 8): Price includes all work included in Sections 081113, 085200, 087100, and as detailed in the construction documents.	$	$
7	Lump Sum	Lump Sum	Finishes (Division 9): Price includes all work included in Sections 092900, 093013, 096513, 096519, 096723, 099113, 099123, and as detailed in the construction documents.	$	$
8	Lump Sum	Lump Sum	Specialties (Division 10): Price includes all work included in Sections 101423, 102113.19, 102800, 104416 and as detailed in the construction documents.	$	$

BIDDER

BIDDER'S SIGNATURE

Item	Quantity	Units	Description	Unit Price	Amount
9	Lump Sum	Lump Sum	Plumbing (Division 22): Price includes all work included in Sections 220000, 220010, 220529, 220533, 220700, 221116, 221119, 221316, 221319, 221329, 223300, 224000, and as detailed in the construction documents.	$	$
10	Lump Sum	Lump Sum	Heating, Ventilating, and Air Conditioning (HVAC) (Division 23): Price includes all work included in Sections 230001, 230005, 230529, 230553, 230593, 230719, 232113, 232300, 233113, 233300, 233423, 238126, and as detailed in the construction documents.	$	$
11	Lump Sum	Lump Sum	Electrical (Division 26): Price includes all work included in Sections 260000, 260002, 260519, 260526, 260533, 260534, 260535, 260543, 260548, 262415, 262726, 262813, 262816, 265000, and as detailed in the construction documents.	$	$
12	Lump Sum	Lump Sum	Earthwork (Division 31): Price includes all work included in Section 313116, and as detailed in the construction documents.	$	$
13	Lump Sum	Lump Sum	ALLOWANCE: Unforeseen conditions and dedicated for additional construction work requested by the owner.	$10,000.00	$10,000.00

Total Amount Bid Based on Estimated Quantities 1 to 13. $ _____

Total Amount Bid Based on Estimated Quantities 1 to 13 (Written):

_____ *DOLLARS*

_____

BIDDER BIDDER'S SIGNATURE

_____

DATE

PROJECT MANUAL VOLUME 1

Borough of Stone Harbor
82nd Street Recreation Facility Tennis Court Building
8100 Second Avenue
Stone Harbor, NJ 08247

Architect Project No. 1862.05

9508 Second Avenue
Stone Harbor, New Jersey 08247
(609) 368-5102

OSK Design Partners, PA
Architects and Land Planners

17 West Knight Avenue, Suite 200
Collingswood, New Jersey 08108

9616 Second Avenue, Suite 201
Stone Harbor, New Jersey 08247

Phone: (856) 854-0580
Fax: (856) 854-0993

Web Site: www.oskdesignpartners.com

Issued: June 22, 2018

END OF DOCUMENT

DOCUMENT 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Gerald S. Blackman, Jr., AIA.
   OSK Design Partners, PA
   17 West Knight Avenue, Suite 200
   Collingswood, NJ 08108
   Phone: (856) 854-0580
2. New Jersey License Number: 21AI01711300.

Signature: _____ Date: JUNE 22, 2018

END OF DOCUMENT 000107

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1.

1. 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 (ACI 301M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I.
2. Fly Ash: ASTM C 618, Class F or C.
3. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: ASTM C 94/C 94M and potable.

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

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. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing 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.

2.8 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Normal-Weight Concrete:

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio: 0.52.
3. Minimum of 500-lbs of cement per cubic yard.

4. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. 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. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3.7 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
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 (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

3.9 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

END OF SECTION 033000 CAST-IN-PLACE CONCRETE

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

A. 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 TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Insulated CMUs: Provide units with rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Concrete Block Insulating Systems.
b. Shelter Enterprises Inc.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Density Classification: Normal weight.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Construction Systems.
b. Euclid Chemical Company (The); an RPM company.
c. Grace Construction Products; W.R. Grace & Co. -- Conn.

G. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dur-O-Wal; a Hohmann & Barnard company.
b. Heckmann Building Products, Inc.
c. Hohmann & Barnard, Inc.
d. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Exterior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
3. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
4. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
5. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

2.5 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advanced Building Products Inc.; Copper Sealtite 2000.
2) York Manufacturing, Inc.; Multi-Flash 500.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 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.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.7 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. Use portland cement-lime mortar.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in 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 C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, 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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.

3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For 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).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 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: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

F. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in grouted masonry, including starting course on footings.
3. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs 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.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than 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.

3.5 MASONRY-JOINT REINFORCEMENT

A. General: 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.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, 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.

3.7 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms 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 that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.8 FIELD QUALITY CONTROL

A. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

B. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

C. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.9 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.10 MASONRY WASTE DISPOSAL

A. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200 CONCRETE UNIT MASONRY

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

A. 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 TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Insulated CMUs: Provide units with rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Concrete Block Insulating Systems.
b. Shelter Enterprises Inc.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Density Classification: Normal weight.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Construction Systems.
b. Euclid Chemical Company (The); an RPM company.
c. Grace Construction Products; W.R. Grace & Co. -- Conn.

G. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dur-O-Wal; a Hohmann & Barnard company.
b. Heckmann Building Products, Inc.
c. Hohmann & Barnard, Inc.
d. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Exterior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
3. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
4. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
5. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

2.5 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advanced Building Products Inc.; Copper Sealtite 2000.
2) York Manufacturing, Inc.; Multi-Flash 500.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 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.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.7 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. Use portland cement-lime mortar.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in 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 C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, 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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.

3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For 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).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 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: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

F. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in grouted masonry, including starting course on footings.
3. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs 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.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than 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.

3.5 MASONRY-JOINT REINFORCEMENT

A. General: 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.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, 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.

3.7 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms 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 that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.8 FIELD QUALITY CONTROL

A. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

B. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

C. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.9 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.10 MASONRY WASTE DISPOSAL

A. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200 CONCRETE UNIT MASONRY

SECTION 044313.16 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stone masonry adhered to unit masonry backup over waterproofing.

1.2 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples:

1. For each stone type indicated.
2. For each color of mortar required.

1.3 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.2 CAST-STONE UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Stone, Inc.
2. American Art Stone, Inc.
3. Architectural Stone, LLC
4. Arriscraft International.
5. Cast Stone by Shelby, LLC
6. Continental Cast Stone.
7. Corinthian Cast Stone, Inc.
8. Stonex Cast Products Company.

B. Cast-Stone Units: Comply with ASTM C 1364.

1. Units shall be manufactured using the vibrant dry tamp method.
2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Color and Texture: As selected by the Architect from the manufacturer's full range to match the decorative CMU masonry veneer for the adjacent Stone Harbor Recreation Department Building. Size of units to be 7-5/8-inch x 15-5/8-inch x 3/4-inch thickness. Finish and texture to match the decorative CMU masonry veneer for the adjacent Stone Harbor Recreation Department Support Building.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 10 percent of portland cement by weight.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Holcim (US) Inc.
b. Lafarge North America Inc.
c. Lehigh Hanson; HeidelbergCement Group.
d. Mutual Materials Co.

D. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
2. White Aggregates: Natural white sand or ground white stone.

E. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products Corporation; a QEP company.
b. Bonsal American, an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. Parex USA, Inc.
i. TEC; H.B. Fuller Construction Products Inc.

F. Water: Potable.

2.4 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: For flashing unexposed to the exterior, use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded with asphalt between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Advanced Building Products Inc.; Copper Sealtite 2000.
2) York Manufacturing, Inc; York 500 Copper Fabric Flashing.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

A. Weep Products: Use one of the following unless otherwise indicated:

1. Mesh Weep Holes: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches (50 mm) high by thickness of stone masonry; in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, provide one of the following:

1) CavClear/Archovations, Inc.
2) Mortar Net Solutions; Mortar Net Weep Vents.

B. Expanded Metal Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m), self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).

2.6 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
b. Dominion Restoration Products.
c. EaCo Chem, Inc.
d. Hydroclean; Hydrochemical Techniques, Inc.
e. PROSOCO, Inc.

2.7 FABRICATION

A. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.

B. Gage backs of stones for adhered veneer if more than 81 sq. in. (522 sq. cm) in area.

C. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 1 inch (25 mm) plus or minus 1/8 inch (3 mm).

D. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples.

1. Finish: Match existing decorative CMU masonry veneer for the adjacent Stone Harbor Recreation Department Support Building.

2.8 MORTAR MIXES

A. General: Do not use admixtures unless otherwise indicated.

1. Do not use calcium chloride.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.

1. Mortar for Setting Stone: Type N.
2. Mortar for Pointing Stone: Type N.

C. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.

D. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.

1. For latex-modified, portland cement, setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.

E. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.

F. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.

G. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.

PART 3 - EXECUTION

3.1 SETTING STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces.
2. Use hammer and chisel to split stone that is fabricated with split surfaces.
3. Pitch face at field-split edges as needed to match stones that are not field split.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones in running bond pattern with course heights uniform, uniform lengths, and uniform joint widths, with offset between vertical joints as indicated.

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch (6 mm) at narrowest points or more than 1/2 inch (13 mm) at widest points.

F. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.
2. Sealing joints is specified in Section 079200 "Joint Sealants."

G. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. At multiwythe masonry walls, extend flashing through stone masonry, turned up a minimum of 8 inches (200 mm), and extend into or through inner wythe to comply with requirements in Section 042000 "Unit Masonry."
2. At sills, extend flashing not less than 4 inches (100 mm) at ends.
3. At ends of head and sill flashing, turn up not less than 2 inches (50 mm) to form end dams.
4. Cut flexible flashing flush with wall face after completing masonry wall construction.

H. Place weep holes in joints where moisture may accumulate, including above shelf angles and at flashing.

1. Use mesh weep holes or open head joints to form weep holes.

2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 16 inches (400 mm) o.c.

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.

3.3 INSTALLATION OF ADHERED STONE MASONRY VENEER

A. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.

B. Install lath over unit masonry and concrete to comply with ASTM C 1063.

C. Install scratch coat over metal lath 3/8 inch (10 mm) thick to comply with ASTM C 926.

D. Coat backs of stone units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.

E. Rake out joints for pointing with mortar to depth of not less than 3/4 inch (19 mm) before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.4 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Concave.

3.5 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and non masonry 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 cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.6 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

END OF SECTION 044313.16 ADHERED STONE MASONRY VENEER

SECTION 047200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-stone trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast-stone units, include dimensions and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

C. Samples:

1. For each color and texture of cast stone required.
2. For colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.

PART 2 - PRODUCTS

2.1 CAST-STONE UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cast Stone by Shelby, LLC.
2. Continental Cast Stone East; Russell, Inc.
3. Metropolitan Cast Stone Corp.
4. Paul Brothers, Inc.
5. Stonex Cast Products, Inc.
6. Van Dyk Trim Stone, LLC.

B. Cast-Stone Units: Comply with ASTM C 1364.

1. Units shall be manufactured using the vibrant dry tamp method.
2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

   a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
   b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
   c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
   d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: As selected by Architect from manufacturer's full range to match existing cast stone masonry units for the existing recreation building.

2.2 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B. Dowels: 1/2-inch- (12-mm-) diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by

cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
   b. EaCo Chem, Inc.
   c. PROSOCO, Inc.

2.3 MORTAR

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

   1. For setting mortar, use Type N.
   2. For pointing mortar, use Type N.

B. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

2.4 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C 1364.

   1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 SETTING CAST STONE IN MORTAR

A. Install cast-stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set units in full bed of mortar with full head joints unless otherwise indicated.

   1. Fill dowel holes and anchor slots with mortar.
   2. Fill collar joints solid as units are set.
   3. Build concealed flashing into mortar joints as units are set.
   4. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
   5. Keep joints at shelf angles open to receive sealant.

C. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

D. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

E. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

F. Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.

G. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.2 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.3 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200 CAST STONE MASONRY

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: All interior partitions.
2. Species:

a. Southern pine or mixed southern pine; SPIB.
b. Northern species; NLGA.
c. Eastern softwoods; NeLMA.
d. Western woods; WCLIB or WWPA.

B. Framing Other Than Non-Load-Bearing Partitions: Any species and No. 2 grade (minimum) with a modulus of elasticity of at least 1,300,000 psi (8970 MPa) and an extreme fiber stress in bending of at least 850 psi (5.86 MPa) for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

1. Application: Framing other than interior partitions not indicated as load-bearing.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

2.7 METAL FRAMING ANCHORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Simpson Strong-Tie Co., Inc., product as indicated on the Drawings; or a comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. USP Structural Connectors.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

C. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000 ROUGH CARPENTRY

SECTION 061533 - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic decking for exterior stair treads.

1.2 ACTION SUBMITTALS

A. Product Data: For plastic decking.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Plastic decking.

PART 2 - PRODUCTS

2.1 PLASTIC DECKING

A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.

1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads (100-psf LL) and spans indicated.

B. Composite Plastic Lumber: Solid shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Trex Company, Inc.; Trex Select, 2-inch square edge; or a comparable product by one of the following:

a. AZEK Building Products, Inc.
b. TimberTech.

2. Decking Standard: ICC-ES AC109.
3. Surface Texture: Woodgrain.
4. Color: As selected by Architect from manufacturer's full range.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Use stainless steel fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Install plastic lumber to comply with manufacturer's written instructions.

C. Secure decking to framing with screws.

END OF SECTION 061533 WOOD PATIO DECKING

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.

PART 2 - PRODUCTS

2.1 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated.

2.2 WALL SHEATHING

A. Plywood Sheathing: Exterior, Structural I sheathing.

2.3 ROOF SHEATHING

A. Plywood Sheathing: Exterior, Structural I sheathing.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

2.5 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.

b. Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION 061600 SHEATHING

SECTION 062013 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior cellular PVC trim.
2. Exterior stairs.

B. Related Requirements:

1. Section 061533 "Wood Patio Decking" for stair treads.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Cellular PVC trim.
3. Foam plastic moldings.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

a. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. Application: All exterior lumber and plywood.

2.3 EXTERIOR TRIM

A. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized, rigid material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide AZEK Building Products, Inc. or a comparable product by one of the following:

   a. CertainTeed Corporation.
   b. Fypon Ltd.
   c. Royal Mouldings Limited.

2. Density: Not less than 31 lb/cu. ft. (500 kg/cu. m).
3. Heat Deflection Temperature: Not less than 130 deg F (54 deg C), according to ASTM D 648.
4. Water Absorption: Not more than 1 percent, according to ASTM D 570.
5. Flame-Spread Index: 75 or less, according to ASTM E 84.

2.4 EXTERIOR STAIRS AND RAILINGS

A. Stairs:

1. Treads: Plastic decking with half-round or rounded edge nosing.
2. Risers: 3/4-inch (19-mm) thick, plastic decking.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
2. For applications not otherwise indicated, provide stainless-steel fasteners.

B. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and with applicable requirements in Section 079200 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install stairs with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and with no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.

3.2 STANDING AND RUNNING TRIM INSTALLATION

A. Install cellular PVC trim to comply with manufacturer's written instructions.

B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water. Cope at returns and miter at corners.

END OF SECTION 062013 EXTERIOR FINISH CARPENTRY

SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing trim for windows.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

1.4 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

1. Provide labels from AWI certification program indicating that woodwork complies with requirements of grades specified.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

C. Casing Pattern: WM 473, 9/16-by-2-1/4-inch (14-by-57-mm) casing.

D. Extension Jambs and Sills: 11/16-inch (17-mm) thick sills. Depth and length as required and indicated on drawings for window types

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Wood Moisture Content for Interior Materials: 5 to 10 percent.

2.4 MISCELLANEOUS MATERIALS

A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.5 FABRICATION

A. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

B. Assemble casings in shop except where shipping limitations require field assembly.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

C. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

END OF SECTION 064600 WOOD TRIM

SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyurethane waterproofing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

A. Single-Component, Modified Polyurethane Waterproofing: ASTM C 836/C 836M and coal-tar free.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Carlisle Coatings & Waterproofing Inc.; CCW-525-V; or a comparable product by one of the following:

a. Anti-Hydro International, Inc.
b. BASF Corporation; Construction Systems.

c. ITW Polymers Sealants North America (formerly Pacific Polymers, Inc.).
d. Tremco Incorporated.

2.2 AUXILIARY MATERIALS

A. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.

B. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

C. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.

1. Backer Rod: Closed-cell polyethylene foam.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

D. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471.

E. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

F. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

3.2 WATERPROOFING APPLICATION

A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471.

B. Unreinforced Waterproofing Applications:

1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 60 mils (1.5 mm).

3.3 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071416 COLD FLUID-APPLIED WATERPROOFING

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards."

B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

C. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company (The); STYROFOAM Brand Insulation or a comparable product by one of the following:

1. DiversiFoam Products.
2. Kingspan Insulation.
3. Owens Corning.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

B. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; or a comparable product by one of the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Knauf Insulation.
4. Owens Corning.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation. Set units with facing placed toward interior of construction for exterior walls.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100 THERMAL INSULATION

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building paper.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding and adhered masonry veneer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Keene Building Products; 10 mm or a comparable product by one of the following:

a. CavClear/Archovations, Inc.
b. Stuc-O-Flex International, Inc.

2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

3.2 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material over building paper and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500 WEATHER BARRIERS

SECTION 074633 - PLASTIC SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes vinyl siding and soffit.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For vinyl siding, include VSI's official certification logo printed on Product Data.

B. Samples: For vinyl siding and soffit including related accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Research/evaluation reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Vinyl Siding Installer Qualifications: A qualified installer who employs a VSI-certified Installer on Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty-five (25) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VINYL SIDING

A. Vinyl Siding: Integrally colored product complying with ASTM D 3679.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Corporation; Straight Edge Perfection Shingles to match the existing recreation building; or a comparable product by one of the following:

a. Gentek Building Products, Inc.
b. RMC Siding.
c. Royal Building Products.

B. Vinyl Siding Certification Program: Provide products that are listed in VSI's list of certified products.

C. Shingle Pattern: 48-inch- (1200-mm-) wide, straight-edge notched sheets with wood-grain texture to match the existing building.

D. Texture: Wood grain.

E. Nominal Thickness: 0.100 inch (2.5 mm).

F. Minimum Profile Depth (Butt Thickness): 3/4 inch (19 mm).

G. Nailing Hem: Double thickness.

H. Finish: Wood-grain print with clear protective coating containing not less than 70 percent PVDF.

1. Colors: As selected by Architect from manufacturer's full range of colors to match the existing recreation building.

2.2 VINYL SOFFIT

A. Vinyl Soffit: Integrally colored product complying with ASTM D 4477.

1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed Corporation; Vinyl Carpentry, Perimeter, Triple 3-1/3" Invisivent, Hidden Ventilation Soffit to match the existing recreation building; or a comparable product by one of the following:

a. Gentek Building Products, Inc.
b. RMC Siding.
c. Royal Building Products.

B. Vinyl Siding Certification Program: Provide products that are listed in VSI's list of certified products.

C. Pattern: 10-inch (254-mm) exposure in single-board, triple, 3-inch (76-mm) board style.

D. Texture: Smooth, Matte.

E. Ventilation: Provide perforated soffit.

F. Nominal Thickness: 0.040 inch (1.0 mm).

G. Minimum Profile Depth: 5/8 inch (16 mm).

H. Colors: As selected by Architect from manufacturer's full range of colors to match the existing recreation building.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories made from same material as adjacent siding unless otherwise indicated.

B. Vinyl Accessories: Integrally colored vinyl accessories complying with ASTM D 3679 except for wind-load resistance.

1. Texture: Wood grain.

C. Colors for Decorative Accessories: As selected by Architect from manufacturer's full range of colors.

D. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

E. Fasteners:

1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
2. For fastening vinyl, use stainless-steel fasteners. Where fasteners are exposed to view, use prefinished aluminum fasteners in color to match item being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Center nails in elongated nailing slots without binding siding to allow for thermal movement.

B. Install vinyl siding and soffit and related accessories according to ASTM D 4756.

C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.2 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074633 PLASTIC SIDING

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed wall sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. As-Milled Finish: Standard two-side bright.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill and similar flashings to extend 4-inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch (0.81 mm) thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
4. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200 SHEET METAL FLASHING AND TRIM

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof-edge drainage systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

C. Samples: For each type of roof specialty and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

1.5 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Products Company.
2. ATAS International, Inc.
3. Berger Building Products, Inc.
4. Castle Metal Products.
5. Cheney Flashing Company.
6. CopperCraft by FABRAL.
7. Drexel Metals.
8. Hickman Company, W. P.
9. Merchant & Evans Inc.
10. Metal-Era, Inc.
11. Perimeter Systems; a division of SAF.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.040 inch (1.02 mm) thick.
2. Gutter Profile: Style K according to SMACNA's "Architectural Sheet Metal Manual."
3. Gutter Size: 4-inches deep x 5-inches wide.
4. Corners: Factory mitered and mechanically clinched and sealed watertight.
5. Gutter Supports: Gutter brackets with finish matching the gutters.
6. Gutter Accessories: Wire ball downspout strainer.

C. Downspouts: Plain round complete with machine-crimped smooth-curve elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Formed Aluminum: 0.040 inch (1.02 mm) thick.
2. Downspout Size: 3-inch diameter.

D. Aluminum Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

E. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FINISHES

A. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.2 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 30 inches (762 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.

1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100 ROOF SPECIALTIES

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Sika Corporation; Joint Sealants.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Construction Systems.
b. LymTal International Inc.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. May National Associates, Inc.; a subsidiary of Sika Corporation.
d. Tremco Incorporated.

2.5 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Alcot Plastics Ltd.
    b. BASF Corporation; Construction Systems.
    c. Construction Foam Products; a division of Nomaco, Inc.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs and resinous flooring.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between wall surfaces and frames of doors and windows.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, NS, 100/50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200 JOINT SEALANTS

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work for doors and frames 100, 101, 102 and 103.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Fleming Door Products Ltd.; Assa Abloy Group Company.
4. Gensteel Doors, Inc.
5. Pioneer Industries.
6. Republic Doors and Frames.
7. Steelcraft; an Allegion brand.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Polystyrene.

3. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
4. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
b. Construction: Full profile welded.

5. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

B. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

D. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.

E. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.5 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) high.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

2.7 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames for doors of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
b. Install frames with removable stops located on secure side of opening.
c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
    c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
    d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113 HOLLOW METAL DOORS AND FRAMES

SECTION 085200 - WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes vinyl-clad wood windows.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Window: Ten (10) years from date of Substantial Completion.
b. Glazing Units: Twenty (20) years from date of Substantial Completion.
c. Vinyl Cladding: Lifetime warranty.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: LC.
2. Minimum Performance Grade: 30.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K).

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.27.

2.2 WOOD WINDOWS

A. Vinyl-Clad Wood Windows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Andersen Windows; Andersen Corporation; 400 Series; or a comparable product.

B. Operating Types: As indicated on Drawings.

C. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.

1. Exterior Finish: Vinyl-clad wood.

a. Color: White.

2. Interior Finish: Manufacturer's standard prime finish for field painting.

D. Insulating-Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.

a. Tint: Clear.
b. Kind: Fully tempered where indicated on Drawings.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Low-E4; Sputtered on second or third surface.

E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

F. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: Estate, Satin Nickel.

G. Horizontal Sliding Window Hardware:

1. Sill Cap/Track: Designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Operated from the inside only.
3. Roller Assemblies: Low-friction design.

H. Hung Window Hardware:

1. Locks and Latches: Operated from the inside only.
2. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis.

I. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

J. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 ACCESSORIES

A. Dividers (False Muntins): Provide simulated divided lite divider grilles in designs indicated on the building elevations for each top sash lite.

1. Quantity and Type: Two per sash, permanently located at exterior and interior lites.
2. Material: Manufacturer's standard.
3. Pattern: As indicated on Drawings.
4. Profile: 3/4-inch. Provide 1 1/2-inch rail and 3/4-inch false muntins for horizontal sliding windows as indicated on the building elevations.
5. Color: Match interior and exterior finish.

2.4 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out and full, outside for double-hung sashes.

B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.

1. Finish for Interior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range.
2. Finish for Exterior Screens: Matching color and finish of cladding.

C. Glass-Fiber Mesh Fabric: 20-by-20 (0.85-by-0.85-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656/D 3656M.

1. Mesh Color: TruScene insect screens.

2.5 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085200 WOOD WINDOWS

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors 100, 101, 102 and 103.

B. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. Thresholds and weather stripping to be installed under other Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Openings Consultant (AOC).

C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: Comply with applicable provisions in ICC A117.1 for door hardware on doors in an accessible route.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
3. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys to Owner by registered mail or overnight package service.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three (3) years from date of Substantial Completion, unless otherwise indicated.

a. Manual Closers: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Pin-and-Barrel-Type Hinges:

1. Basis-of-Design Product: Subject to compliance with requirements, provide McKinney Products Company; an ASSA ABLOY Group company; MCK-FM300 or a comparable product by one of the following:

a. Hager Companies.
b. Lawrence Hardware Inc.

2.3 AUXILIARY LOCKS

A. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide SARGENT Manufacturing Company; ASSA ABLOY; 4870 Series, 4875-11-73-7P Deadlock or a comparable product by one of the following:

a. Arrow USA; an ASSA ABLOY Group company.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. Cal-Royal Products, Inc.
d. Hager Companies.
e. Medeco Security Locks; an ASSA ABLOY Group company.
f. Yale Security Inc; an ASSA ABLOY Group company.

2.4 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

2.5 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
2. Existing System:

a. Master key or grand master key locks to Owner's existing system.

3. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.

2.6 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Forms+Surfaces.
c. Hager Companies.
d. Hiawatha, Inc; a division of the Activar Construction Products Group.
e. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
f. Trimco.

2.7 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide SARGENT Manufacturing Company; ASSA ABLOY; 351 Series Powerglide 351-SC x 351A or a comparable product by one of the following:

   a. Allegion plc.
   b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
   c. DORMA Americas.
   d. Norton Door Controls; an ASSA ABLOY Group company.
   e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
   f. Yale Security Inc; an ASSA ABLOY Group company.

2.8 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allegion plc.
   b. Baldwin Hardware Corporation.
   c. Cal-Royal Products, Inc.
   d. Hager Companies.
   e. Hiawatha, Inc; a division of the Activar Construction Products Group.
   f. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
   g. Trimco.

2.9 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. M-D Building Products, Inc.
   b. Pemko Manufacturing Co.
   c. Reese Enterprises, Inc.
   d. Zero International, Inc.

2.10 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Pemko Manufacturing Co.; Latching Panic Exit Threshold 2005 AT or a comparable product by one of the following:

a. M-D Building Products, Inc.
b. National Guard Products, Inc.
c. Reese Enterprises, Inc.
d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
e. Zero International, Inc.

2.11 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allegion plc.
b. Baldwin Hardware Corporation.
c. Hager Companies.
d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
e. Trimco.

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.13 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

G. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

H. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 DOOR HARDWARE SCHEDULE

Door Hardware Set No. 1
Door Nos. 100, 101, 102 and 103; each to have the following:

No.	Item	Description	Manufacturer	Finish
1	Hanging Devices	Continuous Hinge	(MCK) MCK-FM300 Edge Mount, Tamper Proof Screws.	US32D
1	Securing Devices	Auxiliary Deadbolt Lock	(SGT) 4870 Series, 4875-11-73-7P Deadlock	US32D
1	Securing Devices	Rim Cylinder Lock	(SGT) Signature Series 10-6300	US32D
1	Closing Devices	Closer (Omit Door 103)	(SGT) 351 Series Powerglide 351-SC x 351A	626
1	Stops and Holders	Wall Stop	(MCK) WS-03	626
1	Accessories	Door Pull	(MCK) 45-degree Offset Door Pull OP4513-CH	630
1	Accessories	Door Push Plate	(MCK) Door Push Plate P055RC, .050-inch	630
1	Miscellaneous Items	Threshold	(PEM) Latching Panic Exit Threshold 2001AT	
1	Miscellaneous Items	Door Bottom	(PEM) 222PK	
1	Miscellaneous Items	Perimeter Gasketing	(PEM) HSS2000xS88BL	

END OF SECTION 087100 DOOR HARDWARE

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.

1. Basis-of-Design Product: Subject to compliance with requirements, provide United States Gypsum Company; DUROCK Cement Board or a comparable product by one of the following:

a. C-Cure.
b. CertainTeed Corporation.
c. Custom Building Products.
d. FinPan, Inc.

e. James Hardie Building Products, Inc.
f. National Gypsum Company.

2. Thickness: 5/8 inch (15.9 mm).

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

a. Cornerbead.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool. Provide sound-attenuation blankets for toilet room interior walls.

D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C 840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints, rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.2 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900 GYPSUM BOARD

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed wall tile.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Each type and composition of tile and for each color and finish required.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to five (5.0%) percent of amount installed for each type, composition, color, pattern, and size indicated.

a. CT-1, Glazed Wall Tiles.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
2. Installer employs Ceramic Tile Education Foundation Certified Installers.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Ceramic Tile Type CT-1: Glazed wall tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide *Dal-Tile Corporation*; Rittenhouse Square Matte Glazed wall tile; or a comparable product by one of the following:

   a. American Olean
   b. American Marazzi Tile, Inc.
   c. Crossville, Inc.
   d. Seneca Tiles, Inc.

2. Module Size: 3 by 6 inches (76 by 152 mm).
1. Face Size Variation: Rectified.
2. Thickness: 5/16 inch (8 mm).
3. Face: Pattern of design indicated, with manufacturer's standard edges.
1. Finish: Matte, opaque glaze.
2. Tile Color and Pattern: #0790 Matte Arctic White.
3. Grout Color: #44 Bright White.
1. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

   a. Base: Coved, module size 3 by 6 inches (76 by 152 mm).
   b. External Corners: Bullnose, same size as adjoining flat tile.
   a. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

7.2 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A.

1. Basis-of-Design Product: Subject to compliance with requirements, provide United States Gypsum Company; DUROCK Cement Board. or a comparable product by one of the following:

   a. C-Cure.
   b. Custom Building Products.
   c. FinPan, Inc.
   d. Georgia-Pacific Building Products.

2. Thickness: 5/8 inch (15.9 mm).

7.3 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX Americas.
b. Boiardi Products Corporation; a QEP company.
c. Bonsal American, an Oldcastle company.
d. Bostik, Inc.
e. C-Cure.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. TEC; H.B. Fuller Construction Products Inc.

2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
3. For wall applications, provide nonsagging mortar.

7.4 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products Corporation; a QEP company.
b. Bonsal American, an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Laticrete International, Inc.
f. MAPEI Corporation.
g. TEC; H.B. Fuller Construction Products Inc.

PART 8 - EXECUTION

8.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

8.2 PREPARATION

A. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

8.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in one-half offset pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Glazed Wall Tile: 1/16 inch (1.6 mm).

8.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.

a. Ceramic Tile Type: CT-1.
b. Thinset Mortar: Latex-portland cement mortar.
c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013 CERAMIC TILING

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base for Pro Shop 100.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Flexco.
3. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove: Provide in areas with resilient flooring.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products until they are the same temperature as the space where they are to be installed.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

   a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

   a. Miter or cope corners to minimize open joints.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513 RESILIENT BASE AND ACCESSORIES

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubber floor tile for the Pro Shop 100.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RUBBER FLOOR TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Flexco; Spextones; or a comparable product by one of the following:

1. American Biltrite.
2. Johnsonite; A Tarkett Company.
3. Mannington Mills, Inc.
4. Mondo America Inc.
5. Nora Rubber Flooring, Freudenberg Building Systems, Inc.

B. Tile Standard: ASTM F 1344, Class I-B, homogeneous rubber tile, through mottled.

C. Hardness: Not less than 85 as required by ASTM F 1344, measured using Shore, Type A durometer per ASTM D 2240.

D. Wearing Surface: Textured.

E. Thickness: 0.125 inch (3.2 mm).

F. Size: 18 by 18 inches (458 by 458 mm).

G. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Cover floor tile until Substantial Completion.

END OF SECTION 096519 RESILIENT TILE FLOORING

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes decorative resinous flooring systems for rooms 101 and 102.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of exposed finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.

    a. Include 48-inch (1200-mm) length of integral cove base with inside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Stonshield HRI by Stonhard, Inc.; or comparable product by one of the following:

1. American Hi-Tech Flooring Company.
2. Arizona Polymer Flooring, Inc.
3. Atlas Minerals & Chemicals, Inc.; Polymer Flooring Division.
4. BASF Construction Chemicals, Inc.; BASF Building Systems.
5. ChemMasters.
6. CornerStone Flooring & Linings.
7. Crawford Laboratories Inc.; Florock.
8. Crossfield Products Corp.; Dex-O-Tex.
9. Crown Polymers, LLC.
10. Delta Polymers, Inc.
11. DUDICK Inc.
12. Dur-A-Flex, Inc.
13. Epoxy Systems, Inc.
14. ICS Garland Inc.
15. International Coatings Inc.
16. ITW Resin Technologies.
17. Key Resin Company.
18. Marbelite International Corp.
19. Micor Company, Inc.
20. NEOGARD; Division of JONES-BLAIR.
21. Northern Industries, Inc.
22. Nox-Crete Products Group.
23. Pacific Polymers, Inc.
24. Palma, Inc.
25. POLY-CARB, Inc.
26. Polymerica, Incorporated.
27. PolySpec.
28. PPG Industries, Inc.
29. Protective Floorings & Linings, Inc.; a division of Chesterton.
30. RBC Industries, Inc.

31. ROCK-TRED Corporation.
32. Rust-Oleum Corporation.
33. Sauereisen.
34. Sherwin-Williams Company; General Polymers.
35. Specifier Products Inc.; Stonecarpet.
36. Tamms Industries, Inc.; a division of The Euclid Chemical Company.
37. Tnemec Company, Inc.
38. Tufco International Inc.
39. Valspar Flooring.

2.2 MATERIALS

A. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 DECORATIVE RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range.
2. Wearing Surface: Textured for slip resistance.
3. Overall System Thickness: 3/16 inch (4.8 mm).

C. Body Coats:

1. Resin: Epoxy.
2. Formulation Description: 100 percent solids.
3. Application Method: Troweled or screeded.
    a. Thickness of Coats: 1/8 inch (3.2 mm).
    b. Number of Coats: Two.
4. Aggregates: Colored quartz (ceramic-coated silica).

D. Topcoat: Sealing or finish coats.

1. Resin: Epoxy.
2. Formulation Description: High solids.
3. Type: Clear.
4. Finish: Matte.
5. Number of Coats: One.

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 5,000-psi minimum per ASTM C 579.
2. Tensile Strength: 1,000-psi minimum per ASTM C 307.
3. Flexural Modulus of Elasticity: 2,000-psi minimum per ASTM C 580.
4. Water Absorption: 0.1% maximum per ASTM C 413.
5. Coefficient of Thermal Expansion: 1.3 x 10-5 in/in ^F per ASTM C 531.
6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
8. Abrasion Resistance: 0.06 gm maximum weight loss per ASTM D 4060.
9. Flammability: Self-extinguishing per ASTM D 635.
10. Critical Radiant Flux: 0.45 W/sq. cm or greater per NFPA 253.
11. Hardness: 80 to 84, Shore D per ASTM D 2240.
12. Bond Strength: Greater than 400-psi, 100 percent concrete failure per ACI 503R.

F. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM C 267 for immersion in the following reagents for no fewer than seven days:

1. Including, but not limited to, citric acid, fatty acid, lactic acid, nitric acid, calcium chloride, calcium hydroxide, sodium chloride, acetone, alcohol, ammonia, corn oil, gasoline, glycerine, fruit juices, vegetable juices, kerosene, lard, linseed oil, mayonnaise, milk, mineral spirits, mineral oils, motor oils, vegetable oils, peanut butter, vinegar and water.

2.4 ACCESSORIES

A. Primer: Type recommended by manufacturer for substrate and body coats indicated.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab area in 24 hours.
    b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
    c. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

B. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 4 inches (100 mm) high.

D. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.

E. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.

F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

G. Protect resinous flooring from damage and wear during the remainder of construction period.

END OF SECTION 096723 RESINOUS FLOORING

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Galvanized metal.
2. Plastic.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); or a comparable product by one of the following:

1. Benjamin Moore & Co.
2. Duron, Inc.
3. M.A.B. Paints.
4. PPG Architectural Finishes, Inc.
5. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates (Doors and Frames):

1. Water-Based Light Industrial Coating System MPI EXT 5.3J:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) Sherwin-Williams Company (The); Pro Industrial Pro-Cryl Universal Primer, B66W310.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Sherwin-Williams Company (The); All Surface Enamel HP Semi Gloss, A41WQ8051.

B. Plastic Trim Fabrication Substrates (Exterior Trim):

1. Latex System MPI EXT 6.8A:

a. Intermediate Coat: Latex, exterior, matching topcoat.
b. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Sherwin-Williams Company (The); Loxon Acrylic Coating, A24W00351.

END OF SECTION 099113 EXTERIOR PAINTING

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Wood.
2. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); or a comparable product by one of the following:

1. Benjamin Moore & Co.
2. Duron, Inc.
3. M.A.B. Paints.
4. PPG Architectural Finishes, Inc.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 INTERIOR PAINTING SCHEDULE

A. Wood Substrates: Wood trim and windows (interior side).

1. High-Performance Architectural Latex System MPI INT 6.3A:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

1) Sherwin-Williams Company (The); PrepRite ProBlock, Primer/Sealer, B51W00620.

b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Sherwin-Williams Company (The); Pro Industrial, Pre-Catalyzed Waterbased Epoxy Egg-Shel, K45W00151.

B. Gypsum Board Substrates:

1. High-Performance Architectural Latex System MPI INT 9.2B:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

1) Sherwin-Williams Company (The); ProMar 200 Zero, B28W02600.

b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Sherwin-Williams Company (The); Pro Industrial, Pre-Catalyzed Waterbased Epoxy Egg-Shel, K45W00151.

END OF SECTION 099123 INTERIOR PAINTING

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs for placement at each exterior door indicated on the Drawings. Refer to the Drawings for the appearance of the signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for signs.

2.2 SIGNS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation.
3. Allen Industries Architectural Signage.
4. Allen Markings.
5. APCO Graphics, Inc.
6. ASE, Inc.
7. ASI Sign Systems, Inc.
8. Best Sign Systems, Inc.
9. Clarke Systems.
10. InPro Corporation (IPC).
11. Mohawk Sign Systems.
12. Nelson-Harkins Industries.

B. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:

a. Inset, Cutout Characters: Sign face routed to receive push-through acrylic graphics.

1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: 0.25 inch (6.35 mm).
b. Color(s): As selected by Architect from manufacturer's full range.
c. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
d. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.
b. Corner Condition in Elevation: Square.

3. Mounting: Surface mounted to wall with adhesive.
4. Surface Finish and Applied Graphics:

a. Integral Acrylic Sheet Color: As selected by Architect from full range of industry colors.
b. Painted Finish and Graphics: Manufacturer's standard, factory-applied acrylic polyurethane, in color as selected by Architect from manufacturer's full range.
c. Overcoat: Manufacturer's standard baked-on clear coating.

5. Provide men's/ladies' pictogram and text signs at toilet room doors 101 and 102. Provide the "international symbol of accessibility" for signs at toilet room doors 101 and 102. Provide sign at door 100 stating "PRO SHOP." The size of signs indicated at these locations shall be 8-inches high x 6-inches wide.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).

2.4 ACCESSORIES

A. Adhesive: As recommended by sign manufacturer.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured

adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101423 PANEL SIGNAGE

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes solid-plastic toilet compartments configured as toilet enclosures for new toilet rooms.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.

C. Samples for each type of toilet compartment material indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; Series 400, Sentinel, Overhead-Braced, Bradmar, Solid Plastic Partitions; or a comparable product by one of the following:

1. American Sanitary Partition Corporation.
2. General Partitions Mfg. Corp.
3. Hadrian Manufacturing Inc.
4. Scranton Products.

B. Toilet-Enclosure Style: Overhead braced.

C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.

D. Pilaster Shoes: Manufacturer's standard design; stainless steel.

E. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.
2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19 PLASTIC TOILET COMPARTMENTS

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Childcare accessories.
4. Underlavatory guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser "B":

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; #5402 or a comparable product by one of the following:

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

B. Liquid-Soap Dispenser "D":

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; #6562 or a comparable product by one of the following:

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 oz.
5. Materials: Soap valve to be chrome-plated brass housing with ABS plastic mechanism. Reservoir to be stainless steel, No. 4 finish (satin).
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

C. Grab Bar "A":

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; #812-AM or a comparable product by one of the following:

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. GAMCO Specialty Accessories; a division of Bobrick.

2. Mounting: Flanges with concealed fasteners.

3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

   a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

D. Mirror Unit "C":

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; #780 or a comparable product by one of the following:

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. GAMCO Specialty Accessories; a division of Bobrick.

2. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick.

   a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

   a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on Drawings.

2.3 WARM-AIR DRYERS

A. High-Speed Warm-Air Dryer "E":

1. Basis-of-Design Product: Subject to compliance with requirements, provide Excel Dryer Inc.; #XL-SB Excelerator or a comparable product by one of the following:

   a. American Specialties, Inc.
   b. Bradley Corporation.
   c. GAMCO Specialty Accessories; a division of Bobrick.
   d. World Dryer Corporation.

2. Description: High-speed, warm-air hand dryer for rapid hand drying.
3. Mounting: Surface mounted.
4. Operation: Electronic-sensor activated with operation time of 20-seconds.
5. Cover Material and Finish: Stainless steel, No. 4 finish (satin).
6. Electrical Requirements: 115 V, 13 A, 1500 W.

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station "F":

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Corporation; #961 or a comparable product by one of the following:

   a. American Specialties, Inc.
   b. GAMCO Specialty Accessories; a division of Bobrick.
   c. Koala Kare Products.

d. SafeStrap Company, Inc. (SSC, Inc.).

2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

a. Engineered to support minimum of 250-lb (113-kg) static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color.
6. Liner Dispenser: Built in.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Plumberex Specialty Products, Inc.
b. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.

3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 102800 TOILET, BATH, AND LAUNDRY ACCESSORIES

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers. Provide one (1) fire extinguisher and mounting bracket to be located in the building as directed by the Architect.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six (6) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amerex Corporation.
    b. Ansul Incorporated; Tyco International.
    c. Badger Fire Protection.
    d. Fire End & Croker Corporation.
    e. Guardian Fire Equipment, Inc.
    f. JL Industries, Inc.; a division of the Activar Construction Products Group.
    g. Kidde Residential and Commercial Division.
    h. Larsens Manufacturing Company.
    i. MOON American.
    j. Potter Roemer LLC.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated 4A-80BC, 10 lbs. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amerex Corporation.
    b. Ansul Incorporated; Tyco International.
    c. Badger Fire Protection.
    d. Fire End & Croker Corporation.
    e. Guardian Fire Equipment, Inc.
    f. JL Industries, Inc.; a division of the Activar Construction Products Group.
    g. Kidde Residential and Commercial Division.
    h. Larsens Manufacturing Company.
    i. MOON American.
    j. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

    a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 48 inches (1220 mm) above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416 FIRE EXTINGUISHERS

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment.
2. Bait-station system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Soil Treatment Application Report: Include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

C. Bait-Station System Installation Report: Include the following:

1. Location of areas and sites conducive to termite feeding and activity.
2. Plan drawing showing number and locations of bait stations.
3. Dated report for each monitoring and inspection occurrence, indicating level of termite activity, procedure, and treatment applied before time of Substantial Completion.
4. Termiticide brand name and manufacturer.
5. Quantities of termiticide and nontoxic termite bait used.
6. Schedule of inspections for one year from date of Substantial Completion.

D. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located

and who employs workers trained and approved by manufacturer to install manufacturer's products.

1.5 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bayer Environmental Science; Premise Pro or a comparable product by one of the following:

a. BASF Corporation.
b. Ensystex, Inc.
c. Syngenta.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

2.2 BAIT-STATION SYSTEM

A. Description: EPA-Registered system acceptable to authorities having jurisdiction. Provide bait stations based on the dimensions of building perimeter indicated on Drawings, according to product's EPA-Registered Label and manufacturer's written instructions.

1. Basis-of-Design Product: Subject to compliance with requirements, provide BASF Corporation ; Advance Termite Bait System. or a comparable product by one of the following:

a. Dow Chemical Company (The).
b. Ensystex, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.

3.2 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
3. Masonry: Treat voids.
4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.3 INSTALLING BAIT-STATION SYSTEM

A. Bait-Station System: Install after construction, including landscaping, is completed.

B. Place bait stations according to product's EPA-Registered Label and manufacturer's written instructions, in the following locations:

1. Conducive sites.
2. In and around infested trees and stumps.
3. In mulch beds.
4. Where wood directly contacts soil.
5. Areas of high soil moisture.
6. Near irrigation sprinkler heads.

7. Each area where roof drainage system, including downspouts and scuppers, drains to soil.
8. Along driplines of roof overhangs without gutters.
9. Where condensate lines from mechanical equipment drip or drain to soil.
10. At plumbing penetrations through ground-supported slabs.
11. Other sites and locations as determined by licensed Installer.

END OF SECTION 313116 TERMITE CONTROL

Specifications

For

82nd Street Recreation Facility Tennis Court Building

Borough of Stone Harbor, Cape May County, New Jersey

June 2018

Prepared by:

DEBLASIO & ASSOCIATES
CONSULTING ENGINEERS AND PLANNERS

4701 New Jersey Avenue, Wildwood, NJ 08260

Marc DeBlasio, P.E., License #: 41599

Set #: 7

D&A File #: SH-C-005

NOTICE TO BIDDERS

Notice is hereby given that sealed proposals will be received by the Municipal Clerk, **Borough of Stone Harbor, Cape May County, New Jersey** for the **82nd Street Recreation Facility Tennis Court Building** opened and read in public at the **Borough of Stone Harbor Municipal Building, 9508 Second Avenue, Stone Harbor, Cape May County, New Jersey** on **July 11, 2018 at 1:30 p.m.** prevailing time.

Bid Documents and Drawings for the proposed work, which have been prepared by DeBlasio & Associates, P.C., are available at the office of said Engineer at 4701 New Jersey Avenue, Wildwood, New Jersey 08260, and may be inspected by prospective bidders during business hours.

Bidders will be furnished with a copy of the Bid Documents by request upon proper notice and payment of a non-refundable charge of $50.00 payable to DeBlasio & Associates, P.C., for reproduction and processing.

Proposals must be made on the standard Proposal Forms in the manner designated in the Bid Documents, must be enclosed in sealed envelopes bearing the name and address of the Bidder, and the name of the work on the outside addressed to Clerk, **Borough of Stone Harbor**; and must be accompanied by a statement of Consent of Surety from a surety company authorized to do business in the State of New Jersey and acceptable to the Borough and either a Bid Bond, Certified or Cashier's Check drawn to the order of the **Borough of Stone Harbor** for not less than ten percent (10%) of the amount bid, except that the check need not exceed $20,000.00. The successful bidder is hereby notified that a performance bond for the full amount of the project is required.

The successful bidder will be required to execute a contract for the performance of the said work or the furnishing of said material or both, as the case may be, and a surety bond to be executed by a reliable surety company in a sum equal to the amount of the contract price for said work and/or material, guaranteeing the performance of the contract, which surety bond and contract shall be approved as to form and execution by the Borough Solicitor.

The bidders shall also be required to comply with the following:

A. Affirmative Action requirements (N.J.S.A. 10:5-31 et. seq.and N.J.A.C. 17:27).
B. Certification Pursuant to P.L. 2012, C.25 (no investment activities in Iranian financial or energy sectors).
C. The provisions of the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et. seq).
D. Americans with Disability Act of 1990, Title II (42 U.S.C. S121 01).
E. Worker and Community Right-to-Know Act (N.J.S.A. 34:5A-1).
F. Stockholder Disclosure Certification (P.L. 1977, C.33, N.J.S.A. 52:25-24.2).

G. Business Registration Certification (N.J.S.A. 52:32-44).
H. Public Works Contractors Registration (N.J.S.A. 34:11-56.48).
I. Consent of Surety (N.J.S.A. 40A:11-22).
J. Addendum Acknowledgement (N.J.S.A. 40A:11-23c. 1), 2) &3)).
K. Subcontractors List (N.J.S.A. 40A:11-16).

The award of the contract for this project will not be made until the necessary funds have been provided by the **Borough of Stone Harbor** in a lawful manner. The **Borough of Stone Harbor** reserves the right to consider the bids for sixty (60) days after the receipt of said bids. The **Borough of Stone Harbor** also reserves the right to reject any or all bids or to waive any informalities in the best interest of the **Borough of Stone Harbor**.

Each proposal and bid must be submitted in accordance with the terms of the aforesaid specifications, must be made on standard proposal forms contained in the bid documents and shall be delivered to the place and hour mentioned above.

BY ORDER OF the Borough of Stone Harbor, Cape May County, New Jersey.

Suzanne Stanford, Municipal Clerk
June 26, 2018

Index of Contents

Borough of Stone Harbor, Cape May County, New Jersey

82nd Street Recreation Facility Tennis Court Building: D&A File # SH-C-005

Description	Page Color	Page
Notice to Bidders	White	NTB-1 to NTB-2
Instruction to Bidders	White	ITB-1 to ITB-16
General Requirements	White	GR-1 to GR-19
Proposal Section	Yellow	PS-1 to PS-26
Contract	White	CT-1 to CT-10
Technical Specifications	White	*Refer to Technical Specifications Table of Contents*
New Jersey Wage Rate Determination	White	Page 1 to Page 65

Instructions To Bidders

1.0. SUBMISSION OF BIDS

A. Sealed bids shall be received by the contracting unit, hereinafter referred to as "Owner," in accordance with public advertisement as required by law, with a copy of said notice being attached hereto and made a part of these specifications.

B. Sealed bids will be received by the designated representative at the time and location as stated in the Notice to Bidders, and at such time and place will be publicly opened and read aloud.

C. The bid shall be submitted in a sealed envelope: (1) addressed to the Owner, (2) bearing the name and address of the bidder written on the face of the envelope, and (3) clearly marked "BID" with the contract title and/or bid # of the contract being bid.

D. It is the bidder's responsibility that bids are presented to the Owner at the time and at the place designated. Bids may be hand delivered or mailed; however, the Owner disclaims any responsibility for bids forwarded by regular or overnight mail. If the bid is sent by express mail service, the designation in sub-section C, above, must also appear on the outside of the express mail envelope. Bids received after the designated time and date will be returned unopened.

E. Sealed bids forwarded to the Owner before the time of opening of bids may be withdrawn upon written application of the bidder who shall be required to produce evidence showing that the individual is or represents the principal or principals involved in the bid. Once bids have been opened, they shall remain firm for a period of sixty (60) calendar days.

F. All prices and amounts must be written in ink or preferably machine-printed. Bids containing any conditions, omissions, unexplained erasures or alterations, items not called for in the bid proposal form, attachment of additive information not required by the specifications, or irregularities of any kind, may be rejected by the Owner. Any changes, whiteouts, strikeouts, etc. in the bid must be initialed in ink by the person signing the bid.

G. Each bid proposal form must give the full business address, business phone, fax, e-mail if available, the contact person of the bidder, and be signed by an authorized representative as follows:
   - Bids by partnerships must furnish the full name of all partners and must be signed in the partnership name by one of the members of the partnership or by an authorized representative, followed by the signature and designation of the person signing.
   - Bids by corporations must be signed in the legal name of the corporation, followed by the name of the State in which incorporated and must contain the signature and designation of the president, secretary or other person authorized to bind the corporation in the matter.
   - Bids by sole-proprietorship shall be signed by the proprietor.
   - When requested, satisfactory evidence of the authority of the officer signing shall be furnished.

H. Bidders are responsible for reviewing all the items contained in the bid documents including but not limited to the specifications, plans, reports, attachments, addenda and regulatory permits as applicable and warrants that the submitted bid complies with all the requirements contained in the bid documents. The bidder also warrants that he/she has made themselves fully aware of the nature of the project, has thoroughly read the bid documents, conducted the necessary site inspections to determine the exact nature of the work and the submitted bid accounts for all costs associated with the bid documents.

I. Bidders shall provide their bid on the Bid Form contained herein. The Owner will not consider conditional bids and will award the contract based on the total bid amount. The total amount bid is defined as the summation of all the quantities for the pay items multiplied by the unit prices in the Bid Form.

J. Bidder should be aware of the following statutes that represent "Truth in Contracting" laws:
- N.J.S.A. 2C:21-34, et seq. governs false claims and representations by bidders. It is a serious crime for the bidder to knowingly submit a false claim and/or knowingly make material misrepresentation.
- N.J.S.A. 2C:27-10 provides that a person commits a crime if said person offers a benefit to a public servant for an official act performed or to be performed by a public servant, which is a violation of official duty.
- N.J.S.A. 2C:27-11 provides that a bidder commits a crime if said person, directly or indirectly, confers or agrees to confer any benefit not allowed by law to a public servant.
- Bidder should consult the statutes or legal counsel for further information.

2.0. BID SECURITY AND BONDING REQUIREMENTS

A. BID GUARANTEE

Bidder shall submit with the bid a certified check, cashier's check or bid bond in the amount of ten percent (10%) of the total price bid, but not in excess of $20,000, payable unconditionally to the Owner. When submitting a Bid Bond, it shall contain Power of Attorney for full amount of Bid Bond from a surety company authorized to do business in the State of New Jersey and acceptable to the Owner. The check or bond of the unsuccessful bidder(s) shall be returned pursuant to N.J.S.A. 40A:11-24a. The check or bond of the bidder to whom the contract is awarded shall be retained until a contract is executed and the required performance bond or other security is submitted. The check or bond of the successful bidder shall be forfeited if the bidder fails to enter into a contract pursuant to N.J.S.A. 40A:11-21.

Failure to submit a bid guarantee shall result in rejection of the bid.

B. CONSENT OF SURETY

Bidder shall submit with the bid a Certificate (Consent of Surety) with Power of Attorney for full amount of bid price from a Surety Company authorized to do business in the State of New Jersey and acceptable to the Owner stating that it will provide said bidder with a Performance Bond in the full amount of the bid. This certificate shall be obtained in order to confirm that the bidder to whom the contract is awarded will furnish Performance and Payment Bonds from an acceptable surety company on behalf of said bidder, any or all subcontractors or by each respective subcontractor or by any combination thereof which results in performance security equal to the total amount of the contract, pursuant to N.J.S.A. 40A:11-22.

Failure to submit a consent of surety form shall result in rejection of the bid.

C. PERFORMANCE BOND

Bidder shall simultaneously with the delivery of the executed contract, submit an executed bond in the amount of one hundred percent (100%) of the acceptable bid as security for the faithful performance of this contract.

The performance bond provided shall not be released until final acceptance of the whole work and then only if any liens or claims have been satisfied. The surety on such bond or bonds shall be a duly authorized surety company authorized to do business in the State of New Jersey pursuant to N.J.S.A. 17:31-5.

Failure to submit this with the executed contract shall be cause for declaring the contract null and void pursuant to N.J.S.A. 40A:11-22.

D. LABOR AND MATERIAL (PAYMENT) BOND

Bidder shall with the delivery of the performance bond submit an executed payment bond to guarantee payment to laborers and suppliers for the labor and material used in the work performed under the contract.

Failure to submit a labor and material bond with the performance bond shall be cause for declaring the contract null and void.

E. MAINTENANCE BOND

1. Upon acceptance of the work by the Owner, the contractor shall submit a maintenance bond (N.J.S.A. 40A:11-16.3) in an amount not to exceed 100% of the project costs guaranteeing against defective quality of work or materials for the period of two (2) years.

3.0. INTERPRETATION AND ADDENDA

A. The bidder understands and agrees that its bid is submitted on the basis of the specifications prepared by the Owner. The bidder accepts the obligation to become familiar with these specifications.

B. Bidders are expected to examine the specifications and related bid documents with care and observe all their requirements. Ambiguities, errors or omissions noted by bidders should be promptly reported in writing to the appropriate official. Any prospective bidder who wishes to challenge a bid specification shall file such challenges in writing with the contracting agent 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 pursuant to N.J.S.A. 40A:11-13. In the event the bidder fails to notify the Owner of such ambiguities, errors or omissions, the bidder shall be bound by the requirements of the specifications and the bidder's submitted bid.

C. No oral interpretation and or clarification of the meaning of the specifications for any goods and services will be made to any bidder. Such request shall be in writing, addressed to the Owner's representative stipulated in the specification. In order to be given consideration, a written request must be received at least seven (7) business days prior to the date fixed for the opening of the bid for goods and services.

All interpretations, clarifications and any supplemental instructions will be in the form of written addenda to the specifications, and will be distributed to all prospective bidders. All addenda so issued

shall become part of the specification and bid documents, and shall be acknowledged by the bidder in the bid. The Owner's interpretations or corrections thereof shall be final.

When issuing addenda, the Owner shall provide required notice prior to the official receipt of bids to any person who has submitted a bid or who has received a bid package pursuant to N.J.S.A. 40A:11-23c.1.

D. Discrepancies in Bids

1. If the amount shown in words and its equivalent in figures do not agree, the written words shall be binding. Ditto marks are not considered writing or printing and shall not be used.

2. If there is a discrepancy between the unit prices and the extended totals, the unit prices shall prevail. In the event there is an error of the summation of the extended totals, the computation by the Owner of the extended totals shall govern.

E. Pre-Bid Conference

If stated in the Notice to Bidders, a pre-bid conference for this proposal will be held on the date, time and location as stated in the Notice to Bidders. Attendance is not mandatory, but is strongly recommended. Failure to attend does not relieve the bidder of any obligations or requirements.

4.0. BRAND NAMES, STANDARDS OF QUALITY AND PERFORMANCE

A. Brand names and/or descriptions used in these specifications are to acquaint bidders with the types of goods and services desired and will be used as a standard by which goods and services offered as equivalent will be evaluated.

B. Variations between the goods and services described and the goods and services offered are to be fully identified and described by the bidder on a separate sheet and submitted with the bid proposal form. Vendor literature WILL NOT suffice in explaining exceptions to these specifications. In the absence of any exceptions by the bidder, it will be presumed and required that the goods and services as described in the bid specification be provided or performed.

C. It is the responsibility of the bidder to document and/or demonstrate the equivalency of the goods and services offered. The Owner reserves the right to evaluate the equivalency of the goods and services.

D. In submitting its bid, the bidder certifies that the goods and services to be furnished will not infringe upon any valid patent or trademark and that the successful bidder shall, at its own expense, defend any and all actions or suits charging such infringement, and will save the Owner harmless from any damages resulting from such infringement.

E. Only manufactured and farm products of the United States, wherever available, shall be used pursuant to N.J.S.A. 40A:11-18.

F. The contractor shall guarantee any or all goods and services supplied under these specifications. Defective or inferior goods shall be replaced at the expense of the contractor. The contractor will be responsible for return freight or restocking charges.

5.0. INSURANCE AND INDEMNIFICATION

A. INSURANCE REQUIREMENTS

1. Prior to the execution of the contract and before the commencement of the start of work, the contractor shall provide proof of insurance in accordance with the requirements listed below.
2. The insurance certificate shall also provide for the Engineer and Municipal Solicitor be named as additional insured.
3. The contractor's insurance shall also pertain to the contractor's subcontractors and material suppliers unless the contractor provides separate insurance for the subcontractors and suppliers.
4. A sample certificate of insurance is included in this section that lists the types and amount of insurance required by the contract.
5. The following types of insurance are required:

    a. Worker's Compensation Insurance
    Workers Compensation insurance shall be maintained in full force during the life of the contract, covering all employees engaged in performance of the contract pursuant to N.J.S.A. 34:15-12(a) and N.J.A.C. 12:235-1.6.

    b. General Liability Insurance
    General liability insurance shall be provided with limits shown on the insurance certificate and shall be maintained in full force during the life of the contract.

    c. Automotive Liability Insurance
    Automotive liability insurance covering contractor for claims arising from owned, hired and non-owned vehicles with limits shown on the insurance certificate and shall be maintained in full force during the life of the contract.

    d. Excess Liability
    Excess liability insurance shall be provided with limits shown on the insurance certificate and shall be maintained in full force during the life of the contract.

B. CERTIFICATES OF THE REQUIRED INSURANCE

Certificates of Insurance for those policies required above shall be submitted with the contract. Such coverage shall be with an insurance company authorized to do business in the State of New Jersey and shall name the Owner as an additional insured.

Self-insured contractors shall submit an affidavit attesting to their self-insured coverage and shall name the Owner, Engineer and Solicitor as an additional insured.

C. INDEMNIFICATION

Bidder shall indemnify and hold harmless the Owner from all claims, suits or actions, and damages or costs of every name and description to which the Owner may be subjected or put by reason of injury to the person or property of another, or the property of the Owner, resulting from negligent acts or omissions on the part of the contractor, the contractor's agents, servants or subcontractors in the delivery of goods and services, or in the performance of the work under the contract.

6.0. PRICING INFORMATION FOR PREPARATION OF BIDS

A. The Owner is exempt from any local, state or federal sales, use or excise tax.

B. The bid submitted shall include the entire cost of the specified items for a complete and acceptable installation in accordance with the bid documents. This shall include but is not limited to furnishing materials, installation, proper workmanship, permit compliance, compliance with the plans and specifications and all else for a standard completion.

C. Contractor shall be responsible for complying with any applicable permits or licenses from any government entity that has jurisdiction to require the same. All bids submitted shall have included this cost for compliance.

D. Bidders shall insert prices for furnishing goods and services required by these specifications. Prices shall be net, including any charges for packing, crating, containers, etc. All transportation charges shall be fully prepaid by the contractor, F.O.B. destination and placement at locations specified by the Owner.

7.0. STATUTORY AND OTHER REQUIREMENTS

The following are mandatory requirements of this bid and contract:

A. MANDATORY AFFIRMATIVE ACTION CERTIFICATION

No firm may be issued a contract unless it complies with the affirmative action provisions of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27-1 et seq. The following information summarizes the full, required regulatory text, which is included as Exhibit A of this bid specification.

1. Goods and Services (including professional services) Contracts

Each contractor shall submit to the public agency, after notification of award but prior to execution of a goods and services contract, one of the following three documents:

a. A photocopy of a valid letter that the contractor is operating under an existing Federally approved or sanctioned affirmative action program (good for one year from the date of the letter); or

b. A photocopy of a Certificate of Employee Information Report approval, issued in accordance with N.J.A.C. 17:27-4; or

c. A photocopy of an Employee Information Report (Form AA 302) provided by the Division and distributed to the public agency to be completed by the contractor in accordance with N.J.A.C. 17:27-4.

2. Maintenance/Construction Contracts

After notification of award, but prior to signing the contract, the contractor shall submit to the public agency compliance officer and the Division of Contract Compliance and Equal Employment Opportunity in Public Contracts (Division) an initial project workforce report (Form AA201) provided to the public agency by the Division for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7.

The contractor shall also submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of the contract to the Division and to the public agency compliance officer. The contractor shall also 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.

B. AMERICANS WITH DISABILITIES ACT OF 1990

Discrimination on the basis of disability in contracting for the purchase of goods and services is prohibited. Bidders are required to read Americans With Disabilities language that is included as Appendix A of this specification and agree that the provisions of Title II of the Act are made a part of the contract. The contractor is obligated to comply with the Act and to hold the Owner harmless.

C. STOCKHOLDER DISCLOSURE

N.J.S.A. 52:25-24.2 provides that no corporation or partnership shall be awarded any contract for the performance of any work or the furnishing of any goods and services, unless, prior to the receipt of the bid or accompanying the bid of said corporation or partnership, bidders shall submit a statement setting forth the names and addresses of all stockholders in the corporation or partnership who own ten percent or more of its stock of any class, or of all individual partners in the partnership who own a ten percent or greater interest therein. The included Statement of Ownership shall be completed and attached to the bid proposal. This requirement applies to all forms of corporations and partnerships, including, but not limited to, limited partnerships, limited liability corporations, limited liability partnerships and Subchapter S corporations. Failure to submit a stockholder disclosure document shall result in rejection of the bid.

D. PROOF OF BUSINESS REGISTRATION

N.J.S.A. 52:32-44 requires that each bidder (contractor) submit proof of business registration with the bid proposal. Proof of registration shall be a copy of the bidder's Business Registration Certificate (BRC). A BRC is obtained from the New Jersey Division of Revenue. Information on obtaining a BRC is available on the internet at www.nj.gov/njbgs or by phone at (609) 292-1730. N.J.S.A. 52:32-44 imposes the following requirements on contractors and all subcontractors that **knowingly** provide goods or perform services for a contractor fulfilling this contract:

1) The contractor shall provide written notice to its subcontractors and suppliers to submit proof of business registration to the contractor;
2) Prior to receipt of final payment from a contracting agency, a contractor must submit to the contacting agency an accurate list of all subcontractors or attest that none was used;

3) During the term of this contract, the contractor and its affiliates shall collect and remit, and shall notify all subcontractors and their affiliates that they must collect and remit to the Director, New Jersey Division of Taxation, 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 this State.

A contractor, subcontractor or supplier who fails to provide proof of business registration or provides false business registration information shall be liable to a penalty of $25 for each day of violation, not to exceed $50,000 for each business registration not properly provided or maintained under a contract with a contracting agency. Information on the law and its requirements is available by calling (609) 292-1730.

E. NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW ACT

The manufacturer or supplier of chemical substances or mixtures shall label them in accordance with the N.J. Worker and Community Right to Know Law (N.J.S.A. 34:5A-1 et seq., and N.J.A.C 8:59-2 et seq.,). Containers that the law and rules require to be labeled shall show the Chemical Abstracts Service number of all the components and the chemical name. Further, all applicable Material Safety Data Sheets (MSDS) - hazardous substance fact sheet - must be furnished.

F. PREVAILING WAGE ACT

Pursuant to N.J.S.A. 34:11-56.25 et seq., contractors on projects for public work shall adhere to all requirements of the New Jersey Prevailing Wage Act. The contractor shall be required to submit a certified payroll record to the Owner within ten (10) days of the payment of the wages. The contractor is also responsible for obtaining and submitting all subcontractors' certified payroll records within the aforementioned time period. The contractor shall submit said certified payrolls in the form set forth in N.J.A.C. 12:60-6.1(c). It is the contractor's responsibility to obtain any additional copies of the certified payroll form to be submitted by contacting the New Jersey Department of Labor and Workforce Development, Division of Workplace Standards. Additional information is available at www.state.nj.us/labor/lsse/lspubcon.html.

G. THE PUBLIC WORKS CONTRACTOR REGISTRATION ACT

N.J.S.A. 34:11-56.48 et seq. requires that a general or prime contractor and any listed subcontractors named in the contractor's bid proposal shall possess a certificate *at the time the bid proposal is submitted.* After bid proposals are received and prior to award of contract, the successful contractor shall submit a copy of the contractor's certification along with those of all listed subcontractors. All non-listed subcontractors and lower tier sub-subcontractors shall be registered prior to starting work on the project. It is the general contractor's responsibility that all non-listed sub-contractors at any tier have their certificate prior to starting work on the job.

Under the law a "contractor" is "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.] It applies to contractors based in New Jersey or in another state.

The law defines "public works projects" as contracts for "public work" as defined in the Prevailing Wage statute [N.J.S.A. 34:11-56.26(5)]. The term means:

- "Construction, reconstruction, demolition, alteration, or repair work, or maintenance work, including painting and decorating, done under contract and paid for in whole or in part out of the funds of a public body, except work performed under a rehabilitation program.
- "Public work" shall also mean construction, reconstruction, demolition, alteration, or repair work, done on any property or premises, whether or not the work is paid for from public funds..."
- "Maintenance work" means the repair of existing facilities when the size, type or extent of such facilities is not thereby changed or increased. While "maintenance" includes painting and decorating and is covered under the law, it does not include work such as routine landscape maintenance or janitorial services.

To register, a contractor must provide the State Department of Labor with a full and accurately completed application form. The form is available online at www.state.nj.us/labor/lsse/lspubcon.html.

N.J.S.A. 34:11-56.55 specifically prohibits accepting applications for registration as a substitute for a certificate of registration.

H. NON-COLLUSION AFFIDAVIT

The Affidavit shall be properly executed and submitted with the bid proposal.

I. PAY TO PLAY

Starting in January 2007, business entities are advised of their responsibility to file an annual disclosure statement of political contributions with the New Jersey Election Law Enforcement Commission (ELEC) pursuant to N.J.S.A. 19:44A-20.27 if they receive contracts in excess of $50,000 from public entities in a calendar year.

Business entities are responsible for determining if filing is necessary. Additional information on this requirement is available from ELEC at 888-313-3532 or at www.elec.state.nj.us.

8.0. METHOD OF CONTRACT AWARD

A. The length of the contract shall be stated in the technical specifications. Pursuant to requirements of N.J.A.C. 5:30-5.1 et seq., any contract resulting from this bid shall be subject to the availability and appropriation of sufficient funds annually. Please see Section X, Termination of Contract, Sub-section E, for additional information.

B. If the award is to be made on the basis of a base bid only, it shall be made to that responsible bidder submitting the lowest base bid.

C. If the award is to be made on the basis of a combination of a base bid with selected options, it shall be made to that responsible bidder submitting the lowest net bid.

D. The form of contract shall be submitted by the Owner to the successful bidder. Terms of the specifications/bid package prevail.

9.0. CAUSES FOR REJECTING BIDS

Bids may be rejected for any of the following reasons:

A. All bids pursuant to N.J.S.A. 40A:11-13.2;

B. If more than one bid is received from an individual, firm or partnership, corporation or association under the same name;

C. Multiple bids from an agent representing competing bidders;

D. The bid is inappropriately unbalanced;

E. The bidder is determined to possess, pursuant to N.J.S.A. 40A:11-4b, Prior Negative Experience; or,

F. If the successful bidder fails to enter into a contract within 21 days, Sundays and holidays excepted, or as otherwise agreed upon by the parties to the contract. In this case at its option, the Owner may accept the bid of the next lowest responsible bidder. (N.J.S.A. 40A:11-24b)

10.0. TERMINATION OF CONTRACT

A. If, through any cause, the contractor shall fail to fulfill in a timely and proper manner obligations under the contract or if the contractor shall violate any of the requirements of the contract, the Owner shall there upon have the right to terminate the contract by giving written notice to the contractor of such termination and specifying the effective date of termination. Such termination shall relieve the Owner of any obligation for balances to the contractor of any sum or sums set forth in the contract. Owner will pay only for goods and services accepted prior to termination.

B. Notwithstanding the above, the contractor shall not be relieved of liability to the Owner for damages sustained by the Owner by virtue of any breach of the contract by the contractor and the Owner may withhold any payments to the contractor for the purpose of compensation until such time as the exact amount of the damage due the Owner from the contractor is determined.

C. The contractor agrees to indemnify and hold the Owner harmless from any liability to subcontractors/suppliers concerning payment for work performed or goods supplied arising out of the lawful termination of the contract by the Owner under this provision.

D. In case of default by the contractor, the Owner may procure the goods or services from other sources and hold the contractor responsible for any excess cost.

E. Continuation of the terms of the contract beyond the fiscal year is contingent on availability of funds in the following year's budget. In the event of unavailability of such funds, the Owner reserves the right to cancel the contract.

F. ACQUISITION, MERGER, SALE AND/OR TRANSFER OF BUSINESS, ETC.

It is understood by all parties that if, during the life of the contract, the contractor disposes of his/her business concern by acquisition, merger, sale and or/transfer or by any means convey his/her interest(s) to another party, all obligations are transferred to that new party. In this event, the new Owner(s) will be required to submit all documentation/legal instruments that were required in the original bid/contract. Any change shall be approved by the Owner.

G. The contractor will not assign any interest in the contract and shall not transfer any interest in the same without the prior written consent of the Owner.

11.0. PAYMENT

A. No payment will be made unless duly authorized by the Owner's authorized representative and accompanied by proper documentation.

B. Payment will be made in accordance with the specifications and requirements in the bid documents.

12.0. DISCLOSURE OF INVESTMENTS IN IRAN

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that neither the person nor entity, nor any of its parents, subsidiaries, or affiliates, is identified on the Department of the Treasury's Chapter 25 list as a person or entity engaged in investment activities in Iran. The Chapter 25 list is found on the Division's website at http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf. Vendors/Bidders must review this list prior to completing the below certification. Failure to complete the certification will render a Vendor's/Bidder's proposal non-responsive. If the Director of the Division of Purchase and Property finds a person or entity to be in violation of the law, s/he shall take action as may be appropriate and 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.

EXHIBIT 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

GOODS, PROFESSIONAL SERVICE AND GENERAL SERVICE CONTRACTS

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 take affirmative action to ensure that such applicants are recruited and employed, 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 action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices 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, where applicable, will send to each labor union or representative or workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer advising the labor union or workers' representative of the contractor's 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.

The contractor or subcontractor agrees to make good faith efforts to employ minority and women workers consistent with the applicable county employment goals established in accordance with N.J.A.C. l7:27-5.2, or a binding determination of the applicable county employment goals determined by the Division, pursuant to N.J.A.C. 17:27-5.2.

The contractor or subcontractor agrees to inform in writing its appropriate recruitment agencies including, but not limited to, employment agencies, placement bureaus, colleges, universities, labor unions, that it does not discriminate on the basis of age, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex, and that it will discontinue the use of any recruitment agency which engages in direct or indirect discriminatory practices.

The contractor or subcontractor agrees to revise any of its testing procedures, if necessary, to assure that all personnel testing conforms with the principles of job-related testing, as established by the statutes and court decisions of the State of New Jersey and as established by applicable Federal law and applicable Federal court decisions.

In conforming with the applicable employment goals, the contractor or subcontractor agrees to review all procedures relating to transfer, upgrading, downgrading and layoff to ensure that all such actions are taken without regard to age, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex, consistent with the statutes and court decisions of the State of New Jersey, and applicable Federal law and applicable Federal court decisions.

The contractor shall submit to the public agency, after notification of award but prior to execution of a goods and services contract, one of the following three documents:

Letter of Federal Affirmative Action Plan Approval

Certificate of Employee Information Report

Employee Information Report Form AA302

The contractor and its subcontractors shall furnish such reports or other documents to the Div. of Contract Compliance & EEO as may be requested by the office 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 Div. of Contract Compliance & EEO for conducting a compliance investigation pursuant to **Subchapter 10 of the Administrative Code at N.J.A.C. 17:27**.

APPENDIX A

AMERICANS WITH DISABILITIES ACT OF 1990
Equal Opportunity for Individuals with Disability

The contractor and the **Borough of Stone Harbor**, (hereafter "Owner") do hereby agree that the provisions of Title 11 of the Americans With Disabilities Act of 1990 (the "Act") *(42 U.S.C. S121 01* 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 there unto, are made a 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 that 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 and 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 ADA 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 practicable after a claim has been made against it, give written notice thereof to the contractor along with full and complete 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 Agreement. 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 Agreement, 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 the Agreement or otherwise at law.

CERTIFICATE OF INSURANCE

Name & Address of Insured

Afforded	Required	Type of Insurance	Policy Number and Insuring Company(ies)	Policy Expiration Date	Limits of Liability: 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)	$1,000,000.00	$
☐	☒	Comprehensive Form			Bodily Injury (Each Accident)	$1,000,000.00	$
☐	☒	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	$5,000,000	$
☐	☒	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: **DeBlasio & Associates, P.C., Owner and Owner's Solicitor**

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 give 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.

General Requirements

1.0 DEFINITIONS

The following words contained in the bid documents and contract shall be defined as follows:

Owner/Contract Unit:	Borough of Stone Harbor, 9508 Second Avenue, Stone Harbor, New Jersey.
Contractor:	The successful bidder who has entered into agreement with the Borough of Stone Harbor to perform the necessary work as outlined according to this contract.
Engineer:	DeBlasio & Associates, P.C. 4701 New Jersey Avenue, Wildwood, New Jersey 08260 (Phone: 609-854-3311).
Addenda:	The additional Contract provisions issued in writing by the Engineer prior to the receipt of bids.
Drawings:	Those drawings specifically entitled for this Contract and listed in the Specifications or in the Addenda, or any detailed drawings furnished by the Engineer pertaining or supplemental to the project.
Calendar Day:	All civil days; the time from midnight to midnight.
Contract:	Drawings, specifications, addenda, regulatory permits, bid dcoument attachments.

2.0 GENERAL PROVISIONS

A. The work performed under this Contract shall comply strictly with all the requirements of the New Jersey Department of Transportation (NJDOT) Standard Specifications for Road and Bridge Construction for 2007 except as amended, modified or supplemented herein and known as the Supplemental Specifications. The Supplementary Specifications Division shall refer to the Paragraphs in the New Jersey Department of Transportation Specifications, 2007. The New Jersey Department of Transportation Standard Construction Details shall govern, except in the drawings prepared for this particular project. The NJDOT Standard Specifications and Standard Construction Details are made part of the Contract by this reference and the Contractor shall be fully familiar with these specifications.

B. The work performed under this Contract shall comply strictly with all of the requirements of the New Jersey Local Public Contracts Law (N.J.S.A. 40A:11-1 et seq.).

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

3.0 NOTICE TO PROCEED

Upon execution of the Contract by the Owner and Contractor, the Contractor will be issued a Notice to Proceed which shall serve as formal authorization to proceed with the project.

4.0 CONTRACTUAL COMPLETION TIME

Upon receipt of the Notice to Proceed from the Engineer, the Contractor shall begin work within ten (10) days and shall complete the contracted work within:

75 Calendar Days

If requested by the Contractor, an extension shall be granted for one day of additional time to complete for each and every day determined by the Engineer to be justifiable. In order for the Engineer to make a determination that an extension is justifiable, the Contractor shall provide the reasons and nature for such an extension and the revised work schedule in writing to the Engineer.

5.0 LIQUIDATED DAMAGES

This Contract includes liquidated damages for the violation of any of the terms and conditions thereof or the failure to perform said contract in accordance with its terms and conditions, or the terms and conditions of P.L.1971, c.198 (C.40A:11-1 et seq.). Both the Owner and Contractor agree upon, fix and determine the following liquidated damages for each calendar day that the Contractor is in default of the Contract Time limits:

- One (1) to thirty (30) days: Five hundred dollars ($500.00) per calendar day
- Greater than thirty (30) days: One thousand dollars ($1,000.00) per calendar day

The Owner shall deduct said liquidated damages separately or in combination with the Contractor's payments, surety company or any other legal remedy available to the Owner.

6.0 CONSTRUCTION SCHEDULE AND PERIODICAL ESTIMATES

Immediately after the execution of the Contract, and before the first payment is made, the Contractor shall deliver to the Engineer a construction progress schedule showing the proposed dates of commencement and completion of various sections of work and the anticipated amount of each monthly payment. No change can be made in the approved schedule except with the approval of the Engineer.

The Contractor shall also furnish to the Engineer:

(1) A detailed estimate giving a complete breakdown of the Contract price in case of lump sum bids.

(2) Periodical itemized estimates of work done for the purpose of making partial payments thereon.

The values employed in making any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the Contract price.

7.0 ENGINEER RESPONSIBILITIES

A. All measurements, inspections and estimates during the progress of the work described under these specifications will be made by the Engineer, or his duly authorized representative. The work shall be executed to his satisfaction and in conformity with his instructions and in such order and sequence as he may approve or direct; provided, however, that all the requirements of this Contract and of these Specifications be fulfilled subject to the final approval of the Engineer.

B. The Engineer shall construe and interpret the bid documents as to the intent and meaning of the contract, including but not limited to project drawings, specifications, addenda, regulatory permits and reports. All interpretations and decisions made by the Engineer shall be considered binding and final.

C. The Engineer shall determine the quality and workmanship of the Contractor's materials and work thru construction observation, testing, review of material shop drawings and any other quantitative measurement means. All binding directions, determinations and requirements will be given by the Engineer in writing.

8.0 ENGINEER'S BENCHMARKS AND STAKES

A. The stakes and benchmarks given by the Engineer shall be carefully preserved by the Contractor who shall furnish all necessary stakes, grade boards, lines and appurtenances for establishing grades and making measurements. If for any reason the Engineer's benchmarks and/or stakes are destroyed or removed, it shall be the responsibility of the Contractor to have stakes replaced at the Contractor's expense.

B. Unless otherwise stated in the Contract, the Contractor shall be responsible for survey and layout of the work from the benchmarks and stakes provided by the Engineer. In the event that the proposed work requires the construction of grades, roadways, curbs, gutters and sidewalks, the Contractor shall submit cut sheets to the Engineer for review.

9.0 INSPECTION

A. The Owner and the Engineer shall have the right to inspect all materials and work done during any phase of construction. The Contractor shall furnish all reasonable facilities and aid to the Engineer for the examination and inspection of any part of the work. No work shall be closed or covered up until it has been duly inspected and approved. Should uncompleted work be covered, the Contractor shall, at his own expense, uncover all such work so that it can be promptly inspected, and after inspection, he shall properly repair and replace all such work if found defective.

B. The Contractor shall provide the Engineer with forty-eight (48) hour notice in advance of the start of any work and shall provide forty-eight (48) hour notice in advance of stopping work.

C. The Engineer may provide construction observation services for the project during normal working hours which is 7:30 a.m. to 4:00 p.m., Monday thru Friday. In the event that the Contractor works outside of normal working hours, then the Contractor shall be responsible for reimbursement of inspection costs and such cost will be deducted from the Contractor payments. In the event that the Contractor completes the work in excess of the contract completion time, then the Contractor shall be responsible for reimbursement of inspection costs and such costs will be deducted from the Contractor payments. The method of reimbursement of inspection costs thru deductions is outlined in Section 9.0 Payments.

D. The Engineer may conduct observation of the project by providing on-site Inspectors to observe the contracted work. The presence and observation of Inspectors does not relieve the Contractor from fulfilling the requirements of the Contract. The Inspector is not authorized to increase or decrease work nor alter the work contained in the Contract.

10.0 PAYMENTS

A. The quantities of work shown on the contract plans and stated in the Bid Form are only approximate and are given for the purpose of comparing bids. During the progress of the work, the Owner may find it necessary to omit as it sees fit, any portion of the work shown on the plans, or it may also find it necessary to increase or decrease the quantities in accordance with the modifications provided for the foregoing section. Payments will be made for the actual quantity of work satisfactorily completed and accepted by the Engineer at the various unit prices bid. Additionally, The Contractor shall provide the Engineer with a detailed breakdown of the price for lump sum line items and contracts.

B. As required in the Prompt Payment of Construction Contracts P.L. 2006, c.96 (Prompt Payment Law), the Contractor is advised that the Owner is defined as an Owner that follows the alternate procedure for local units when local policies require Owner approval authorizing the payment of bills as defined in N.J.S.A. 2A:30A-2a.

C. Any contract, the total price of which exceeds $100,000.00, entered into by the Owner involving the construction, reconstruction, alteration, repair or maintenance of any building, structure, facility or other improvement to real property, shall provide for partial payments to be made at least once each month as the work progresses, unless the Contractor shall agree to deposit bonds with the Contracting Unit pursuant to P.L.1979, c.152 (C.40A:11-16.1).

D. In addition to ensuring the Contractor has performed in accordance with the contract and that the work has been approved and certified by the Owner or the Owner's "authorized approving agent," the following provisions apply:

1.) The 20th calendar day deadline of the default procedure to approve and certify, or decide to withhold full or partial payment is deferred until the public meeting following 20 calendar days of the billing date, at which time the bill must be approved for payment or notice provided as to why the bill or any portion of it will not be approved.

2.) If the billing is approved, the 30-day payment requirement of the default is replaced by the requirement that the bill be paid in the payment cycle following the meeting.

3.) Upon receipt of the bill from the Contractor, the Contractor shall be given prompt and timely notice of any denial of payment, its deficiency, and what is required to resolve it.

4.) The Owner will establish a periodic billing date at the preconstruction meeting, to define the timing of the payment process.

E. Retainage Requirements

1.) In accordance with N.J.S.A. 40A:11-16.1, whenever any contract, the total price of which exceeds $100,000.00, entered into by a Contracting Unit, for the construction, reconstruction, alteration or repair of any building, structure, facility or other improvement to real property, requires the withholding of payment of a percentage of the amount of the contract, the Contractor may 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 purposes of this section, "value" shall mean par value or current market value, whichever is lower. 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 cash payments withheld shall be credited to the Contracting Unit.

2.) With respect to any contract entered into by a Contracting Unit pursuant to section 1 of P.L.1979, c.464 (C.40A:11-16.2) for which the Contractor shall agree to the withholding of payments pursuant to P.L.1979, c.152 (C.40A:11-16.1), 2% of the amount due on each partial payment shall be withheld by the Contracting Unit pending completion of the contract. Upon acceptance of the work performed

pursuant to the contract for which the Contractor has agreed to the withholding of payments pursuant to subsection a. of this section, all amounts being withheld by the contracting unit shall be released and paid in full to the Contractor within 45 days of the final acceptance date agreed upon by the Contractor and the Contracting Unit, without further withholding of any amount for any purpose whatsoever, provided that the contract has been completed as indicated. If the Contracting Unit requires maintenance security after acceptance of the work performed pursuant to the contract, such security shall be obtained in the form of a maintenance bond. The maintenance bond shall be no longer than two years and shall be no more than 100% of the project costs.

F. Deduction of Payments

1.) The Owner may withhold a payment or partial payment from the Contractor to protect the Owner from defective work, non compliance of regulatory laws, loss due to injury, loss to damage of property, loss due to damage of the work and acts of neglect.

2.) The Owner may withhold a payment or partial payment from the Contractor to settle payment claims due to material suppliers, subcontractors and any other person performing services for the Contract.

3.) The Owner shall deduct costs for inspection as outlined in Section 8.0 Inspection. The amount deducted shall be calculated at the Engineer's contractual hourly rate with the Owner multiplied by the number of man-hours in excess as defined in Section 8.0 Inspection.

4.) The Owner may withhold or deduct a payment or partial payment from the Contractor for liquidated damages as described in Section 5.0 Liquidated Damages.

11.0 VALUE ENGINEERING CHANGE ORDERS

In accordance with N.J.S.A. 40A:11-16.6, the Contractor may submit a Value Engineering Change Order. As such, the following statutory requirements apply to such a submission:

A. Definitions relative to value engineering change orders; requirement for certain contracts a. For the purpose of this act: "Construction" means the construction, reconstruction, demolition, erection, alteration, or repair of a structure or other improvement to real property, other than the construction, reconstruction, demolition, or renovation of a public building. "Value engineering construction change order" means a change order results in cost reductions to a project or any portion of the work from the original bid specifications after a construction contract is awarded. "Value engineering construction proposal" means 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.

B. All construction contracts issued by a contracting unit when the total price of the originally awarded contract equals or exceeds $5,000,000, shall allow for value engineering construction change orders to be approved after the award of the contract.

C. Value engineering construction change orders shall be subject to the following provisions:

1.) 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.

2.) 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.

3.) 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.

4.) The contracting unit's engineer shall prepare a written report for the Owner 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.

5.) The proposal shall not be approved unless the engineer reports to the Owner 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.

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

7.) 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.

8.) 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.

9.) A contracting unit shall include in its bid specifications and contract documents procedures to regulate the value engineering construction change order process. Such procedures shall be based on procedures established by the New Jersey Department of Transportation, or any other appropriate State agency, or rules adopted by the director of the Division of Local Government Services.

D. This section shall not invalidate or impair rules regarding change orders adopted by the director of the Division of Local Government Services prior to the effective date of this act. Notwithstanding any provision of P.L.1968, c.410 (C.52:14B-1 et seq.) to the contrary, the director may adopt, immediately upon filing with the Office of Administrative Law, such rules and regulations as the director deems necessary to implement the provisions of P.L.2005, c.67 (C.40A:11-16.6) which shall be effective for a period not to exceed 12 months. The regulations shall thereafter be amended, adopted or readopted in accordance with the provisions of P.L.1968, c.410 (C.52:14B-1 et seq.).

12. CHANGE ORDERS

A. No changes in quantities, work performed, services rendered, materials, supplies or equipment delivered or provided shall be authorized, permitted or accepted except by the procedures established herein. All change orders unless otherwise stated in this subchapter shall be subject to the following:

1.) Each change order shall be in writing and shall be numbered consecutively (beginning with number one) and attached to the original purchase order or contract for each project.

2.) Change orders which result in payment reduction below the originally contracted price may be made by locally established procedure, provided that any change orders increasing cost on the same contract shall include reference to such reductions.

3.) Quantities of items or work shall not be changed in such a manner as to nullify the effect of the competitive determination of lowest responsible bidder which was made at the time of contract award, if at said time the changes could have been reasonably foreseen.

4.) Responsibility required by these rules to be exercised specifically by the Owner, including authorization of change orders, shall not be delegated except for minor field (site) modifications pursuant to N.J.A.C. 5:30-11.4.

5.) Change orders may be executed by the representative appointed by the Owner but the responsibility for the authorization of change orders shall not be delegated by the Owner except for minor field (site) modifications pursuant to N.J.A.C. 5:3011.4.

6.) Change orders shall be used to change the number of units or items originally advertised and contracted for, provided that: i. Unit prices or a price methodology were sought in the original specifications and included in the contract; ii. The original specification and the contract included a provision that the unit prices could be so used; and iii. If (a)6i and ii above were not contained in the original specification, a change order shall not be issued.

7.) Change orders shall not be used to substantially change the quality or character of the items or work to be provided, inasmuch as such would have been a determining factor in the original bidding.

8.) Change orders shall not serve the purpose of escalation clauses and, therefore, shall not be utilized to effectuate upward price adjustments.

9.) Total number of change orders executed for a particular contract shall not cause the originally awarded contract price to be exceeded by more than 20 percent unless otherwise authorized by these rules.

10.) If proposed change orders do exceed the 20 percent limitation of (a)9 above, no work shall be performed or purchases made until the procedures of N.J.A.C. 5:30-11.9 have been completed. If the Owner determines issuance of the change order is not justifiable, a new contract shall be executed in accordance with the Local Public Contracts Law.

11.) Before authorizing any change orders resulting in additional expenditures, the availability of funds shall be certified in writing by the chief financial officer or certifying finance officer, as appropriate.

12.) The 20 percent limitation of (a)9 above shall not apply to emergency situations as defined within N.J.S.A. 40A:11-6. 13. Change order authorizations shall not be withheld until the completion of the entire project.

13.0 MATERIALS AND WORKMANSHIP

A. All materials used in the construction shall be new, except where reclaimed materials are indicated, and shall be furnished by the Contractor, and shall be approved by the Engineer. Request for approval of materials shall state the proposed source. All workmanship shall be satisfactory to the Engineer. Materials and workmanship not satisfactory shall be replaced by the Contractor without expense to the Owner. The Contractor shall comply with provisions of the N.J.S.A. 40A:11-18 requiring that preference be given to the use of domestic materials.

B. Any work, or part of work which, in the opinion of the Engineer has not been done in accordance with these specifications or the instructions of the Engineer, or any material which does not conform to the specifications shall be removed and replaced in a satisfactory manner at the Contractor's expense.

C. The Contractor shall provide all materials, equipment and supplies free of any mortgages, liens, conditional provisions or any other circumstance that subjects the Owner to a claim by the sellers of such materials, equipment and supplies.

D. At the request of the Engineer, the Contractor shall provide samples of materials to ascertain compliance with and select items specified in the Contract.

E. In case the Contractor finds the specifications on the plans are not sufficiently clear or complete, he shall request the Engineer to provide supplementary plans and specifications and the Engineer will provide such additional information as may be necessary. Such request shall be made in writing at least two (2) weeks prior to the time that such drawings or specifications are to be needed and no delay caused by the Engineer in supplying such information, shall be considered as neglect or default. No responsibility, either direct or implied, is assumed by the Engineer for omissions or duplications by the Contractor or his subcontractors, due to real or alleged error in arrangement of matter in these Contract documents.

F. Before ordering materials, the Contractor shall submit shop drawing, submittals and/or material specifications to the Engineer for review of conformity to the Contract. The Contractor shall provide six (6) copies of the shop drawings, submittals and/or material specifications either in paper or electronic format to the Engineer. If requested by the Engineer, the Contractor shall furnish additional copies, technical information or corrections to the submitted shop drawings, submittals and material specifications.

14.0 PERMITS AND LAWS

The Contractor shall comply with all Federal, State, County, and Local laws, regulations, resolutions and ordinances affecting the work. The Contractor shall obtain and pay for all necessary licenses and permits unless otherwise specified in the Contract. The Contractor shall be solely responsible for any damages resulting from his/her neglect to obey all laws, regulations, rules and ordinances and should he/she perform any work called for by the specifications or drawings, knowing it to be contrary to such laws, regulations, resolutions, rules and ordinances and without notifying the Engineer in writing and obtaining written consent to proceed, he/she shall bear all costs and damages arising therefrom.

15.0. OR EQUAL CLAUSE

The Owner, without invalidating the Contract, may make changes by altering, adding to or deducting from the work the Contract sum being adjusted accordingly. All such work shall be executed in conformity with the terms and conditions of the original Contract unless otherwise provided in the order for same.

Any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.

Each order for changes shall be in the form of an Order on Contract, bearing the signed approval of the Engineer and the signed acceptance of Contractor except in the case of disagreement as to the value of changes when the Contractor's signature to the Order will not be mandatory. The Order on Contract shall describe or enumerate the work to be performed and state the price, if any, to be added to or deducted from the Contract sum. If the nature of the work is such that an Order on Contract, as above, cannot be issued until the work has been advanced sufficiently to obtain exact quantities, said work will be authorized in writing by the Engineer with the accompanying statement than an Order on Contract will be issued when the necessary information is at hand.

Except as provided in the above paragraph, no change shall be made unless in pursuance of an Order on Contract and no claim for an addition to the Contract sum shall be valid unless so ordered. If the Contractor believes that any instructions, by drawings or otherwise, involves extra cost under his Contract, he shall give the Engineer written notice thereof within ten (10) days after receipt of such instructions and await instruction before proceeding to execute such work.

The value of any change shall be determined by one or more of the following methods:

(a) By acceptance in a lump sum.

(b) By estimate of the cost of labor and materials plus overhead and profit.

(c) By cost of labor and materials, plus overhead and profit cost to be determined as the work progresses.

Method (a) will be accepted only for items of work in which an analysis of the cost of labor and materials is impracticable and the Contractor shall submit satisfactory evidence to substantiate the amount of the lump sum.

If the work is done by Method (b), the Contractor shall submit an estimate showing an analysis of the cost of labor and materials.

If the work is done by Method (c), the Contractor shall submit a report of the actual cost of labor and materials.

If the work is done directly by the Contractor, overhead in an amount of ten percent (10%) may be added to the lump sum if Method (a) is accepted, or to the cost of labor and materials if Method (b) or (c) is used, and to the lump sum of labor and materials plus overhead there may be added ten percent (10%) for profit.

If the work is done by a subcontractor, overhead in an amount of five percent (5%) may be added to the lump sum if Method (a) is accepted, or to the cost of labor and materials if Method (b) or (c) is used and to the amount of the lump sum of labor and materials plus overhead there may be added ten percent (10%) for profit.

The Engineer shall determine by which one of the following methods the value of any changes shall be computed.

In case no agreement can be reached between the Engineer and the Contractor as to value of the change, the Contractor shall proceed with the work upon receipt of a written order from the Engineer, which order shall set forth the work to be done and the price allowed by the Owner. The said order may be reviewed before final certificate is issued, if it is deemed that such action is necessary or advisable.

Compliance with the above-mentioned order shall not be regarded as a waiver of the Contractor's right to file and establish a claim in Court.

"Overhead" shall be defined to include only the following items:

(a) Premium based on Bond.

(b) Premium on insurance, other than Workmen's Compensation Insurance, Unemployment Insurance or Old Age Security Insurance.

(c) Transportation and expense of executive officers.

(d) Communications.

(e) Executive officers time.

(f) Expenses of the executive office.

(g) Advertising and promotion expenses.

16.0 TRAFFIC CONTROL

The Contractor shall be responsible for the maintenance of traffic with a minimum of one lane open at all times for emergency vehicles. Where necessary, steel plates shall be employed to provide for the maintenance of traffic as directed by the Engineer.

Under no circumstances will a street or roadway be completely closed to traffic, without permission from the Engineer, and the Contractor upon receiving permission from the Engineer, shall notify the Police Department in such closing. Traffic control devices shall conform to the Manual on Uniform Traffic Control Devices (MUTCD)- Latest Edition. Access to driveways shall be maintained at all times. No driveways shall remain blocked overnight.

The Contractor shall conduct his operations in such manner as to provide minimum safety for all employees on the work and the public as well. The Contractor shall provide suitable bridges, barricades, railings, or other protection about open trenches on excavations and any necessary traffic directors, detour signs, yellow lights and danger signals for any obstruction to traffic. Hazard warning lights shall be transistorized, double face, flash type.

The Contractor shall notifiy residents by door-hangers at least forty-eight (48) hours in advance before starting construction work on roadways.

17.0 RESPONSIBILITY AND DAMAGE

The Contractor shall be responsible for all parts of his work, temporary or permanent, until the Contract is acceptable by the Owner and he shall thoroughly protect all work, finished or unfinished, against damage from any cause. The use of part or all of the work by the Owner shall not relieve the Contractor of this responsibility.

In the course of his operations, the Contractor may disturb certain seeded and lawn areas, driveways and parking areas, curbing, fences, hedges, walks, etc. along the site of the project which he will be required to restore to the condition in which he found them. Unless otherwise directed by the Engineer, the Contractor shall dig up, handle, protect and properly reset hedges, small trees and shrubbery along the line of or adjacent to the work, and shall take all reasonable care of this work. All materials shall be in a living condition when reset or the Contractor shall replace them with new stock. Trees, tree branches and roots shall not be mutilated or cut except by permission of the Engineer. When permitted to cut tree roots, the ends shall be cut off smooth. All trees in improved areas and close enough to the work to be in danger of damage by the construction operations shall be effectually boxed and securely braced, if necessary, before construction begins. Tree branches shall be tied back and under no circumstances may they be cut off or damaged. The Contractor shall carefully observe the extent of the above as there will be no extra compensation allowed to him for restoring the same.

The Contractor shall be responsible for damage to life and property due to his operations and shall provide all necessary guards, rails, night lights, etc.

If either party to this Contract should suffer damage in any manner because of any wrongful act of neglect of the other party or if anyone employed by him, they shall be reimbursed by the other party for such damage.

Claims under this clause shall be made in writing to the party liable within two (2) weeks of the first observance of such damage and in no case later than the time of the final payment and shall be adjusted by agreement or arbitration.

18.0 LIENS

Neither the final payment nor any part of the retained percentage shall become due until the Contractor, if required, shall deliver to the Owner a complete release of all liens arising out of this contract or receipts in full in lieu thereof and, if required in either case, an affidavit that so far as he has knowledge or information, the releases and receipts include all labor and material for which a lien could be filed; but the Contractor may if any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a lien including all costs and a reasonable attorney's fee.

19.0 INDEMNITY

The Contractor shall indemnify and save harmless the Owner from and against all losses and all claims, demands, payments, suits, actions, recovered against it by reason of any act, or omission of the Contractor, his agents or employees in the execution of the work of the guarding of it and in case any such action is brought against the Owner, the Contractor shall immediately take charge of and defend the same at his own cost and expense. "Indemnity and Hold Harmless Agreement" is incorporated herein by reference.

20.0 ASSIGNMENT OF CONTRACT

Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any monies due to him hereunder without the previous consent of the Owner.

21.0 SUBCONTRACTS – NON SPECIALTY

The Contractors shall submit to the Engineer in writing one (1) week prior to the commencement of work or sooner, the names of the subcontractors proposed for the principal parts of the work, if any.

The Contractor agrees that he is fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the Contract documents shall create any contractual relation between any subcontractor and the Owner.

22.0 PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision of law, regulations and clauses required by law applicable to the Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as it were included herein.

23.0 MATERIAL TESTING

The Engineer, may, at his discretion, require materials to be used in performing the work under this Contract to be tested. Whenever so instructed by the Engineer, the Contractor shall furnish representative samples of materials and shall forward them to the office of the Engineer. The entire cost of sampling and testing such materials shall be borne by the Contractor.

24.0 PERMITS

The Contractor shall obtain all permits and licenses, as required by the Owner or other authorities having jurisdiction.

25.0 REMOVAL OF RUBBISH

As the work progresses, all rubbish, refuse and unused materials and tools shall be left in a neat and orderly condition ready for use. All ditches, pits and other excavation made by the Contractor for his convenience in prosecuting the work, shall be filled up, and all embankments, temporary spoil banks and similar deposits not shown on the plans, shall be removed prior to the completion of the Contract, in such manner and to such extent as the Engineer may direct.

26.0 WATER, ELECTRIC, UTILITIES, ETC.

The Contractor must arrange for his own water supply, electric service, and other utilities, paying for all permits, connections, piping meters, consumption, etc., as required.

27.0 SUBSURFACE STRUCTURES AND UTILITIES

The location of existing substructures and utilities shown on the drawings and contained in the Contract have been secured from various sources and is not guaranteed to be accurate. The Contractor is advised to determine the exact location of ll subsurface structures and utilities.

In the event that the subsurface structure and utilities locations deviate from what is shown on the drawings and Contract documents, the Contractor shall notify the Engineer immediately.

The Contractor shall be responsible for any damage to existing subsurface structures and utility facilities as a result of the work contained in the Contract. In the event that the Contractor damages any existing subsurface structures and utility facilities, the Contractor shall notify the affected utility authority and Engineer immediately.

28.0 DISPOSAL OF EXCAVATED MATERIALS

The Contractor shall dispose of excavated material, such as rock, earth, pavement, etc., when in the opinion of the Engineer, said material is deemed unusable for use in the Contract.

Disposal sites of unusable materials shall be at the Contractor's option, but will conform to State, County and Local laws.

29.0 FINAL CLEAN-UP

Before the final acceptance of the project, the Contractor shall remove all equipment, temporary work, unused and useless materials, rubbish and temporary buildings, repair or replace in an acceptable manner fences or other private or public property which may have been damaged or destroyed on account of the prosecution of the work, fill all depressions and water pockets on public and private property caused by his operations, remove all obstructions from waterways caused by his work, clean all inlets and manholes within and adjacent to the site of the project which have been obstructed by his operations, and leave the site of the project and adjacent public and private property in a neat and presentable condition wherever his operations have disturbed conditions existing at the time of starting work.

The Contractor shall procure and submit to the Engineer signed statements from property owners affected that he has fulfilled his obligations in the matters enumerated above with regard to their respective properties.

30.0 NO DAMAGE FOR DELAY OR EXPENSE TO CONTRACTOR, SUBCONTRACTOR, MATERIAL SUPPLIERS, THEIR AGENTS OR EMPLOYEES DURING PERIODS OF DELAY.

The terms, as set forth below, supercede any inconsistent provisions of the Specifications and or Contract and are limited only by N.J.S.A. 40A:11-19 and 18A:18A-41 as applicable.

In the event that the Contractor, Subcontractor, Material Supplier, their agents and employees (hereinafter, collectively, referred to as the "Contractor") are delayed in the performance and/or completion of the work by any act then and in all such cases where there has been delays, suspensions or other impacts caused to the Contractor, as a result of said delay the parties hereto agree that the only remedy of the Contractor shall be limited to an extension of time for the completion of the Contract.

The only limitation to this provision shall be as limited by N.J.S.A. 40A:11-19 and 18A:18A-41 as may be applicable. The Owner and Contractor specifically agree that the inability to obtain permits and the like, or by changes ordered in the work, strikes, lockouts, fire weather conditions, acts of God, and unusual delays by common carriers are contemplated by the parties in setting a completion date under the contract and as envisioned by N.J.S.A. 40A:11-19 and 18A:18A-41.

The decision as to the amount of time permitted by way of extension caused by delay shall be solely that of the Engineer. The Contractor agrees that this provision shall be part of any Contract or any Subcontract relative to the scope of the work to be conducted. The parties agree that they shall not seek any damages for delay impacts caused by delays of any nature, sort or type. The sole remedy under these circumstances is an extension to the time to perform, except as permitted by N.J.S.A. 40:11-19 and 18A:18A-41. In the event that a Contractor asserts in an Arbitration, lawsuit or proceeding of any type, an entitlement to money damages or other

damages other than an extension of time in violation of this provision, the Owner and Engineer shall be entitled to reasonable attorney's fees and costs incurred in the defense of the matter, in the event it is determined that the Contractor was only entitled to an extension of time to perform.

No such extensions of time shall be made for any one or more delays unless within seven (7) days after the beginning of such delay a written request for additional time shall be filed with the Engineer.

No claim for damages or any claim other than for an extension of time, as herein provided, shall be made or asserted against the Owner or any of their agents or employees, with the exception of the limitations provided by N.J.S.A. 40A:11-19 and 18A:18A-41.

Anything contained in the Specifications, the Contract, the drawings or any other document to the contrary notwithstanding, the Contractor shall not be entitled to the damages or to extra compensation by reason of delays occasioned by the proceedings to review the awarding of the Contract to the Contractor or to review the awarding of any other Contract to any other Contractor.

31.0 DISPUTE RESOLUTION

The Owner and Contractor agree to submit to forms of alternative dispute resolution (ADR) prior to submitting to a Court of adjudication in the event that a dispute arises under the Contract. Forms of ADR may include mediation, arbitration and non-binding arbitration and shall be conducted in accordance with State Law, industry standards and American Arbitration Association (AAA) guidelines.

ADR shall not be applicable to statutory items contained in the New Jersey Local Public Contracts Law, N.J.S.A. 40A:11-1 et seq.

32.0 LABOR STANDARDS

The Contractor and any hired subcontractors shall comply with all of the State of New Jersey Labor Laws, including but not limited to New Jersey Department of Labor Laws, N.J.S.A. 10:2-1 to 10:2-4 inclusive and the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et.seq as amended).

A copy of the prevailing wage determination applicable to the contract and issued by the New Jersey Department of Labor is on file at the Engineer's office and are attached to this Contract.

Prior to final acceptance of the work completed in the Contract and final payment to the Contractor, the Contrcator shall complete the Prevailing Wage Certification which is enclosed in the Contract for use by the Contractor.

Prior to final acceptance of the work completed in the Contract and final payment to the Contractor, the Contractor shall submit certified payrolls to the Owner with a copy to the Engineer in compliance with N.J.A.C. 12:60.

33.0 SITE SAFETY

The Contractor is responsible for site safety both in the Owner's right-of-way and private property for the duration of the Contract. The Contractor shall provide a Site Safety Form to the Engineer or Inspector on a daily basis for the duration of the Contract. A copy of the Site Safety Form is enclosed in the Contract for use by the Contractor.

The Contractor shall not be approved for payment unless the Site Safety Form for each day worked in the payment request period has been furnished by the Contractor to the Engineer or Inspector.

34.0 FINAL PAYMENT AND PROJECT CLOSE OUT

Final acceptance of the project and the issuance of the final payment made by the Owner shall release the Owner from any claims and liabilities pertaining to the Contractor. Final payment and project close out does not relieve the Contractor or its agents of any obligations contained in the Contract.

Prior to final payment and project close out, the Contractor shall submit the following items:

1. Maintenance Bond.
2. As-Built Plans (if applicable).
3. Prevailing Wage Certification.
4. All Monthly Manning Project Reports.
5. All Certified Payrolls Reports.
6. All Site Safety Forms.
7. Full Release and Waiver of Lien Certification.
8. Any other documentation required and included in the Contract.

SITE SAFETY FORM

Town: **Borough of Stone Harbor**

Project Name: **82nd Street Recreation Facility Tennis Court Building**

County: **Cape May**

D&A Project Number: **SH-C-005**

I hereby certify that I understand and acknowledge all Federal, State and Local laws regulating construction work and safety requirements for the progression of the work in this Contract.

On this day, I also certify that all Federal, State and Local laws regulating site safety have been followed and are in accordance with the Contract, except as noted:

☐ Trench Conditions
☐ Traffic Control
☐ Fall Protection
☐ Entry to Subsurface Structures
☐ Properly Maintained Equipment
☐ Work in Proximity to Electric Lines

☐ Other _____

_____

_____

☐ None
Comments/Resolutions _____

_____

_____

Contractor:_____

By: _____
Authorized Representative

I executed this form at_____on_____
Time Date

NEW JERSEY PREVAILING WAGE PAYMENT CERTIFICATION

Town: **Borough of Stone Harbor**

Project Name: **82nd Street Recreation Facility Tennis Court Building**

County: **Cape May**

D&A Project Number: **SH-C-005**

I hereby certify that all workmen employed by my company (Contractor) and subcontractors have been paid in full and all payments have been made in accordance with the New Jersey Department of Labor requirements and New Jersey Prevailing Wage Act (Chapter 150 of Laws of 1963). I also hereby certify that all suppliers, vendors and any other applicable entities that were utilized for this Contract have been paid in full and that all claims, liens, contigencies and mortgages are not remaining. Lastly, I acknowledge that this form must be fully executed and submitted to the Engineer and Owner to receive finaly payment.

Contractor:_____

By: _____
Authorized Representative

_____
Authorized Representative Title

I executed this form at_____on_____
Time Date

Sworn and suscribed before me this_____ day of _____2018,

_____
Notary Public of New Jersey

CONTRACT

THIS AGREEMENT, made this **DATE** between **The Borough of Stone Harbor, Cape May County, New Jersey** (OWNER) **CONTRACTOR** (CONTRACTOR).

WITNESSETH, that CONTRACTOR, for and in consideration of the payment of **$AMOUNT** money hereinafter mentioned, hereby covenants and agrees to with the OWNER the following:

1. That the CONTRACTOR shall and will provide and furnish all materials, equipment, tools and apparatus, and perform all of the work and labor required for the **82nd Street Recreation Facility Tennis Court Building, Borough of Stone Harbor, Cape May County, New Jersey - D&A Project Number: SH-C-005** in strict accordance with and in all respect conforming to the Plans and Specifications prepared therefore by DeBlasio & Associates, P.C., 4701 New Jersey Aveue, Wildwood, New Jersey (ENGINEER), which Plans and Specifications are made part thereof to the same effect as though they were herein particularly set forth in detail.

2. The CONTRACTOR shall carry on the work with such force at such times and seasons as may be agreed to by the ENGINEER. The CONTRACTOR shall, unless otherwise directed as hereinafter provided, proceed promptly upon the signing of the Contract and approval of the surety bond and Contract as to form and execution by the Municipal Solicitor of the OWNER, to execute all work in every respect in a thorough and workmanlike manner and shall fully and entirely complete all the work embraced in this Contract within the contrcat completion time. It is, however, provided that additional time shall be allowed by way of extension of the period for the completion of such work equal to the total period for the completion of such work equal to the total period of delay caused by injunction or other legal proceeding, insofar as such proceedings and delays shall

necessarily prevent the CONTRACTOR from proceeding with such work, but no delay shall be allowed for unless such legal proceedings shall be diligently prosecuted by the said CONTRACTOR, and provided further that, in no case shall such delay be deemed to begin until the CONTRACTOR shall have given written notice to the OWNER of the injunction or other order and the papers which the same shall have been granted.

3. In the event the CONTRACTOR shall fail to complete the work within the Contractul Completion Time or in accordance with the terms and conditions of this Contract, the OWNER shall be entitiled to liquidated damages as prescribed in the Contract Documents.

4. The OWNER may suspend the whole or any part of the work herein contained to be done, if it shall deem it for the best interest of the OWNER to do so, without compensation to the CONTRACTOR for such suspension, other than extending the time for completion of the work as much as it may have been delayed by such suspension. The only limitation to this provision shall be as limited by N.J.S.A. 40A:11-19 and 18A:18A-41 as may be applicable. The parties specifically agree that the inability to obtain permits and the like, or by changes ordered in the work, strikes, lockouts, fire, weather conditions, acts of God, and unusual delays by common carriers are contemplated by the parties in setting a completion date under the Contract as envisioned by N.J.S.A. 40A:11-19 and 18A:18A-41. During such suspension all materials delivered upon, but not placed in the work, shall be neatly piled by the CONTRACTOR so as not to obstruct public travel, or shall be removed from the line of the work at the direction of the OWNER, and unless the materials be moved by the CONTRACTOR, upon such direction, the materials shall be removed by the OWNER and expense thereof will be charged to the CONTRACTOR.

5. Neither an extension of time for any reason beyond the time fixed herein for the completion of the Contract, nor the delivery or acceptance of any articles or materials called for by the Contract, shall be deemed to be a waiver by the OWNER of the right to abrogate this Contract for abandonment or delay in the manner herein provided.

6. If the work to be done under this agreement shall be abandoned by the CONTRACTOR, or if at any time the ENGINEER employed by the OWNER shall be of the opinion and shall so certify in writing to the OWNER that the Contract is being unnecessarily and unreasonably delayed, or that the CONTRACTOR is willfully violating any of the conditions or covenants of this Contract or Specifications or is executing the same in bad faith, or not in accord with the terms hereof, or if the work is not fully completed within the time named in the Contract for its completion, the OWNER may notify the CONTRACTOR to discontinue all work, or any part thereof, under this Contract, by a written notice to be served upon the CONTRACTOR as above provided, and thereupon the CONTRACTOR shall discontinue said work, or such part thereof and the said OWNER shall thereupon have the power to contract for the completion of the Contract, or to place such and so many persons as it may deem advisable, by contract or otherwise, to work at and complete the work herein described or such part thereof, and to use such materials as said OWNER may find upon the line of work, and to procure such other materials for the completion of same, and to charge the expense of said labor and materials to the CONTRACTOR and the expense so charged shall be deducted and paid by the OWNER of the moneys as may be due, or any at any time thereafter to grow due to the CONTRACTOR under and by virtue of this Contract, or any part thereof; and in case such expense shall exceed the amount which would have been payable under the Contract, if the same had been completed by the CONTRACTOR, said CONTRACTOR, shall pay the amount of the excess to the OWNER; and in case such expense is less than said amount, said

CONTRACTOR shall forfeit all claim to the difference; and when any particular part of the work is being carried on by the OWNER by the Contract or otherwise, under the provisions of this clause of the Contract, the CONTRACTOR shall continue the remainder of the work in conformity with the terms of this Contract, and in such manner as to in no way hinder or interfere with the persons or workmen employed as above provided by the party of the first part by contract or otherwise to do any part of the work or to complete the same under the provisions of this article of the contract.

7. At all times during the performance of the work hereunder, the CONTRACTOR shall place proper guards upon and around the same for the prevention of accidents, and at night shall keep and maintain suitable and sufficient light reflective barricades and barrels, and shall save harmless the OWNER against and from all suits and actions of every name, kind and description, brought against it or them, and all costs and damages to which they may be put on account, or by reason of any injury to the person or property of another, resulting from negligence or carelessness in the performance of the work, or in guarding the same, or from any improper materials used in the prosecution of the work or by or on account of any act or omission of the CONTRACTOR or his agents.

8. In case any injury is done to property of the OWNER or others in the vicinity of the work, including adjoining lands, or to any sidewalks or curbs in consequence of its employees or agents in carrying out any of the provisions or requirements of this Contract, or caused by surface water runoff onto lands of others, the CONTRACTOR shall make such repairs or replacements as are necessary in consequence thereof at CONTRACTOR's own expense and to the satisfaction of the OWNER, or other landowners, and is case of failure on the part of the CONTRACTOR to promptly make such repairs or replacements, they may be made by the OWNER, and the expense thereof shall be deducted out of the money due

or to grow due to the CONTRACTOR under this Contract. CONTRACTOR shall indemnify and hold harmless the OWNER, its agents and employees from any and all claims of personal injury or property damage as provided in the "Indemnity & Hold Harmless Agreement" which is part of the Bid Documents, which is hereby incorporated by reference herein as if set forth in its entirety.

9. The CONTRACTOR shall be held responsible for any claim made against the OWNER for any infringements of patents, by use of patented articles in the construction and completion of the work, or any process connected with the work agreed to be performed under the said Contract or of any materials used upon said work and will save harmless and indemnify the OWNER and ENGINEER of all costs, expenses, and damages which the OWNER shall be obligated to pay by reason of any infringements of patents used in the construction and completion of the work.

10. If at any time during the period of two (2) years from the date of the acceptance of the whole work under this agreement as evidenced by the final certificate of the ENGINEERs, and the resolution duly passed by the OWNER accepting the whole of said work, any part or parts of the work may show any movement, deficiency or defect other than caused by ordinary wear and tear or ordinary action of the elements, the same shall be repaired and made whole and secure by the CONTRACTOR to the satisfaction of the OWNER, and in case the CONTRACTOR shall neglect or refuse to correct any such defect or make such repair within ten (10) days from the date of service of notice requiring the same to be done, served upon the CONTRACTOR, with the agent in charge of the work or by certified mail, or by serving the same upon the designated agent in this State, the OWNER shall have the right to purchase such materials as it shall deem necessary and to employ such persons as it may deem proper to undertake and complete said repairs and to charge to expense thereof to the CONTRACTOR and Surety, and the said

CONTRACTOR or the Surety shall pay out all such expense to which the OWNER may be part by reason of the neglect or refusal of said CONTRACTOR or Surety to make such repairs.

11. Just previous to the expiration of the respective guarantee periods, the entire work shall be inspected by the OWNER or its representative, and if any defect or movement is found or any repairs are needed beyond those naturally resultant from wear and tear or the action of the elements a notice shall be issued requiring such defects to be corrected and such repairs to be made in conformity with this agreement and said CONTRACTOR and the Surety shall not be relieved from their bond until the required work has been satisfactorily done, or until the OWNER shall have been reimbursed for the total expense of any and all repairs which have been made by the OWNER because of the neglect or refusal of said CONTRACTOR or Surety to comply with the notices issued as herein provided, during said guarantee period.

12. It is further agreed by and between the OWNER and CONTRACTOR hereto that all requirements and terms set forth in the Contract Documents, defined in Attachment "A" for each of the various divisions of the work applying shall be and form an integral part of this Contract and be made part hereof as though the same were herein fully set forth. To prevent all disputes and litigations the ENGINEER shall determine all questions in relation to the work and materials and construction hereof, and in all cases decide every question which may arise relative to the execution and performance of this Contract on the part of the CONTRACTOR and the said ENGINEER's Estimate and decision shall be final and conclusive and such estimate and decision, in case any question shall arise, shall be a condition precedent to the right of the CONTRACTOR to receive any money under this Contract. Any doubt as to the meaning of the Specifications, or any obscurity as to the wording of them will be explained by the ENGINEER, and all

directions and explanations requisite or necessary to complete, explain or make more definite any of the provisions of the Specifications and give them due effect, will be given by the ENGINEER.

13. The CONTRACTOR agrees to obtain and pay for all necessary permits as indicated in the Contract documents and conform to and abide by all rules and regulations of the OWNER, all rules, regulations and ordinances of the OWNER in which thework is being carried on, and all statutes of the State of New Jersey, all rules, regulations and directive orders and laws of the Federal Government or any branch or Bureau thereof, particularly those pertaining to the maximum hours and the minimum and maximum wages of workmen employed in the performance of this Contract and as provided in R.S. 34:10-1 et. seq.

14. In the event that during the progress of the work under the Contract, any materials to be used or being used by the CONTRACTOR in the work are deemed unsuitable, improper or not in conformity with the Specifications and this Contract, the ENGINEER of the OWNER may enter upon the said work and prohibit the further progress of the work or the use of said faulty materials pending the final decision of the ENGINEER, and if the ENGINEER shall condemn said materials or any part thereof, the same shall at once be removed from said construction and materials approved by the ENGINEER substituted in lieu and place thereof.

15. No claim shall be submitted by the CONTRACTOR for extra work performed or materials furnished hereunder by the CONTRACTOR to the OWNER of by the ENGINEER certified for payment, unless there shall have been executed and delivered an agreement in writing therefore between the parties hereto prior to the performance of said extra work or furnishings of said extra material, providing for the payment of the cost thereof by the OWNER.

16. (a) In the hiring of laborers, workmen and mechanics for the performance of workunder this contract or any sub-contract hereunder, neither the CONTRACTOR nor any person acting in behalf of said CONTRACTOR or any subcontrcator, shall, by reason of race, creed, color, national origin or ancestry, discriminate against any citizen of the State of New Jersey who is qualified and available to perform the work which the employment relates.

(b) Neither the CONTRACTOR, subcontrcator nor any person in behalf thereof shall, in any manner discriminate against or intimidate any employee hired for the performance of work under this Contract on account of race, creed, color, national origin or ancestry.

(c) This Contract may be cancelled or terminated by the OWNER, and all money due or to become due hereunder may be forfeited, for a second or any subsequent violation of the terms and conditions of this section of the Contract, in pursuance of Chapter 171 of the Laws of 1945 of the State of New Jersey.

17. It is further agreed between the parties hereto that only domestic materials produced and manufactured in the United States of America shall be used in the work.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be sealed with their seals and executed by their duly authorized officers, the day and year first aforesaid.

OWNER: _____

ATTEST: _____

Clerk

CONTRACTOR: _____

ATTEST: _____

ATTACHMENT 'A' TO CONTRACT

1) The term "CONTRACT DOCUMENTS" means and includes the following:

   A) Notice to Bidders

   B) Instruction to Bidders

   C) Proposal Section

   D) General Requirements

   E) Contract Form

   F) Specifications prepared by DeBlasio & Associates, P.C.

   G) Specifications prepared by Olivieri Shousky and Kiss Associates

   H) Specifications prepared by Moore Consulting Engineers

   I) Drawings prepared by DeBlasio & Associates, P.C.

   J) Drawings prepared by Olivieri Shousky and Kiss Associates

   K) Drawings prepared by Moore Consulting Engineers

   L) Prevailing Wage Determinations

   M) All Addenda.

Technical Specifications

Table of Contents

82ND Street Recreation Facility Tennis Court Building
Borough of Stone Harbor
D&A File # SH-C-005

Description	Page Color	Section
Scope of Work	White	Scope of Work
Site Submittals	White	02100
As-Built Plans	White	02120
Cleaning and Restorations	White	02130
Clearing Site	White	02140
Soil Erosion and Sediment Control	White	02200
Trench Excavation and Backfill	White	02220
Dewatering	White	02240
Sidewalks and Driveways	White	02290
Site Excavation, Filling and Grading	White	02315
Water Service Line (Copper)	White	02622
HDPE Sanitary Sewer Force Main & Fittings	White	02627
High Density Polyethylene Culvert Pipe	White	02710
Sodding	White	02811
NJDOT Standard Specifications for Roadway and Bridge Construction, 2007	n/a	*See Below
Soil Boring Log	White	n/a

** NJDOT Standard Specifications for Roadway and Bridge Construction, 2007 can be viewed at the Engineer's office or obtained from:*

http://www.state.nj.us/transportation/eng/specs/index.shtml#StandardSpecifications

SCOPE OF WORK

The scope of work shall include, but is not limited to the complete construction of a new tennis court building at the 82nd Street Recreation Facility Tennis Courts as shown and detailed in the bid documents.

The proposed project timeline is listed below:

1. Advertise Project for Public Bidding – June 26, 2018
2. Bid Opening – July 11, 2018 at 1:30 PM
3. Possible Council Contract Award – July 17, 2018
4. Project Schedule, Submittals, Order Materials – July 17 to September 4, 2018
5. Start of Construction/Mobilization – September 5, 2018
6. Completion Date – November 19, 2018

A. General:

1. The project bid documents were completed by the following professionals and consist of the following items:

   a.) DeBlasio & Associates, P.C.: Project Plans and Specifications – Procurement and Construction Management
   b.) Moore Consulting Engineers, LLC: Project Plans and Specifications – Mechanical, Electrical, Plumbing Engineer
   c.) Olivieri Shousky & Kiss, P.A.: Project Plans and Specifications – Project Architect

2. The Contractor shall be responsible for conducting a site inspection to determine the exact nature and extent of work.

3. The contractor is advised that the daily liquidated damages listed in the proposal section of the bid documentation will be administered. The costs have been calculated based on the estimate of daily costs each day the building opening is delayed.

4. The General Contractor shall provide, coordinate, and direct all required subcontracting services necessary to provide a turnkey construction project.

5. The General Contractor shall limit the onsite storage of construction materials and equipment to as minimal as possible to prevent any disruption or accessibility to the daily tennis court operations.

6. Submittals – The contractor shall submit all product submittals prior to construction of any work related to the submittals. All product submittals shall be provided by the contractor no later than 30 days after the contract award (NO EXCEPTIONS). To aid in expediting submittals the following will apply:

   a.) Should a delay occur due to rejections of incomplete shop drawing submittals, the Contractor is still bound to the project completion date.

7. The Contractor shall obtain all utility markouts, verify the locations of all utilities both horizontally and vertically prior to the start of construction and notify the engineer of any conflicts. The contractor shall also be responsible for coordinating all utility relocation that may be necessary. There will be no separate payment for this work.

8. The Contractor shall be responsible for removal and disposal of all excess unwanted materials and debris from the project site. These are to be disposed of in a manner acceptable to the Borough. Should the Borough of Stone Harbor want any excess material the material shall be delivered to the Borough's site at no additional charge.

9. The Contractor shall be responsible for all construction layout. No baseline will be provided for this contract. No separate payment shall be made for this work.

10. Separate payment shall not be made for, sawcuts, trench bracing, adjustments to existing irrigation system and sprinkler heads, elevational adjustments of cleanouts, gas valve boxes, water meter pits, water service valves, sprinkler heads, conductors or conduits damaged during construction, unless otherwise specifically indicated on the plans.

11. The Work consists of the following:

    The Contractor is responsible and obligated to successfully complete the entire project and to complete each and every necessary detail of every item specified and/or shown on the Contract Drawings and in the Specifications regardless of whether or not a particular detail is specifically mentioned. Any detail of work called out on the Drawings but not called out in the Specifications, or any item of work or detail not called out on the Drawings, but called out in the Specifications, shall be considered the same as if it was called out in both the Specifications and the Drawings. The scope of work shall include the following:

    a. The Contractor is responsible for providing all Site, Structural and Architectural features and finishes including, but not limited to; demolition, interior walls, masonry, structural steel, miscellaneous steel, walls, floors, roof, finishes and ceiling systems as listed within the specifications and shown on the contract drawings and as required to complete the new work.
    b. The Contractor is responsible for verifying all existing conditions of the existing site, foundation, footings, and structural framing. All new work shall be coordinated and developed within and on the existing structures provided.
    c. The contractor shall provide all Mechanical, Plumbing, Electrical, and all Structural components and Systems.

        1.) The furnishing and installation of all other appurtenances as shown on the drawings, unless noted otherwise.
        2.) The furnishing of all materials specified herein required for a complete installation.
        3.) All work shall be in accordance with accepted manufacturers and construction standards, applicable codes and directives of officials having jurisdiction over the project.

4.) All demolition materials, construction debris and scrap shall be disposed of in a legal manner and in accordance with all local, State and Federal or other agencies having jurisdiction unless noted otherwise for reuse or salvage.

5.) The Contractor shall include all materials and work for the completed project as detailed within the contract documents.

6.) The above Scope of Work outlines the general items and distribution of work and shall not be construed as being all-inclusive.

7.) The Contractor shall be responsible for applying for and obtaining any and all permits required to satisfactorily complete this construction project. Any costs related to obtaining permits shall not be included in the proposal but shall be directly forwarded to the owner in fee.

8.) Codes and Standards: The work as specified and performed for this project shall comply with all applicable New Construction Sections of the State of New Jersey, Building Code. Said work shall comply with the latest revision of the NEC, NESC, LSC, UL, IBC, NSPC, IMC, IFGC, NFPA, ASME, ANSI or other applicable codes.

12. The contractor shall be responsible for obtaining all necessary Borough of Stone Harbor Construction Code Office permits and the fees for these permits will be waived.

13. Project will be constructed under a single prime general construction contract.

14. Coordination of Work:

A. The Contractor is responsible for the overall coordination of the construction work of the project. At the beginning of the project the Contractor shall prepare a Construction Progress Schedule in a form acceptable to the Engineer and Owner, indicating the phasing of all Subcontractors' work and the work of his own forces. This submission is required on or before the Pre-construction Conference Meeting (No Exception).

B. The Contractor is responsible for the distribution and delegation to his sub-contractors and suppliers of the construction funds provided within the contract. At the beginning of the project the Contractor shall prepare a complete detailed "Schedule of Values" in a form acceptable to the Engineer and owner. This submission is required on or before the Pre-construction Conference Meeting (No Exception).

C. Construction progress meetings will be held on a bi-weekly basis by the Engineer/Architect after the pre-construction meeting. The progress schedule shall then be reviewed at the project meetings with the Engineer, Architect, City Personnel, the Contractors, and the Subcontractors. At these meetings adjustments will be made to the schedule which are agreeable to all and deemed appropriate for the timely completion of the project.

D. The Engineer will monitor the progress of the project and review the status of the completion of work at the regular project meetings. If one or more of the Subcontractors is delaying the progress of the project, it shall be the

responsibility of the Contractor to take necessary action to bring that portion of the project back on schedule.

E. All costs related to project coordination shall be included by the Contractor. In addition, the Contractor shall be responsible to provide clear, safe, unobstructed access to the tennis courts at all times. The Contractor shall provide the necessary material and labor to accommodate access. Cost for all materials and labor, including premium time if necessary, shall be included in the bid.

END OF SCOPE

SITE SUBMITTALS
SECTION 02100

02100.01 DESCRIPTION
The Contractor shall provide submittals and material cut sheets for all items proposed to be used in the contract. A list of required submittals is attached, and additional submissions may be required by the Engineer, at no additional cost to the owner. The Contractor shall provide submittals and product information either by traditional, paper copy means or electronic media (email, external drives, etc.).

02100.02 MATERIALS
Not applicable.

02100.03 CONSTRUCTION

02100.03.01 PROCESS
Coordinate submittal preparation with performance of construction activities, and with purchasing or fabrication, delivery and related activities. Transmit in an expeditious manner and in advance of ordering materials to avoid delays. Allow two weeks for review. Allow more time if processing must be delayed for coordination with other submittals. The Engineer will advise the Contractor when a submittal must be delayed for coordination. Allow two weeks for reprocessing each submittal. No extension of time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to Permit processing.

02100.03.02 CONTRACTOR SCHEDULE
Submit a fully developed, bar-chart type construction schedule at the preconstruction meeting. Provide a separate bar for each construction activity and a vertical line to identify the first working day of each week. Coordinate the construction schedule with the list of subcontracts, submittal schedule, progress reports, payment requests and other schedules. Indicate completion in advance of the date established for substantial completion. Indicate substantial completion on the schedule to allow time for the Engineer's procedures necessary for certification of substantial completion. Revise each schedule after each meeting or activity, where revisions have been made. Issue the updated schedules concurrently with report of each meeting. The revised schedule must be approved by the engineer.

02100.03.03 DAILY REPORTS
Prepare a daily construction report, recording information concerning events at the site. Submit duplicate copies to the Engineer at weekly intervals. Include the following information:

List of subcontractors at the site.
High and low temperatures, general weather conditions.
Accidents, stoppages, delays, shortages, losses.
Emergency procedures.
Change orders received, implemented.
Partial completions, occupancies.
Substantial completions authorized.

02100.03.04 SHOP DRAWINGS AND PRODUCT INFORMATION
Submit new information, drawn to accurate scale. Indicate deviations from contract documents. Do not reproduce contract documents or copy standard information as the basis of shop drawings. Include the

following information:

Dimensions
Identification of products and materials included.
Notation of coordination requirements.
Notation of dimensions established by field measurement.

Collect product data into a single submittal for each element or system. Mark each copy to show applicable choices and options. Where product data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

Manufacturer's printed recommendations.
Compliance with recognized trade association standards.
Compliance with recognized testing agency standards.
Application of testing agency labels and seals.
Notation of dimensions verified by field measurement.
Notation of coordination requirements.

Submit six (6) copies of each required submittal. The Engineer will retain four (4) copies and return the others marked with action taken and corrections or modifications required.

02100.03.05 SAMPLES

Submit full-size samples cured and finished as specified and identical to the product proposed. Mount, display or package samples to facilitate review. Prepare samples to match the Engineer's sample. Include the following:

Generic description
Compliance with recognized standards
Source
Availability and delivery time
Product name or name of manufacturer

Submit samples for review of kind, color, pattern and texture for a final check of these characteristics and a comparison of these characteristics between the final submittal and the component as delivered and installed. Where variations are inherent in the product, submit multiple units that show limits of the variations. Refer to other sections for samples that illustrate details of assembly, fabrication techniques, workmanship, connections, operation and similar characteristics. Refer to other sections for samples to be returned for incorporation in the work. Such samples must be undamaged at the time of use. On the transmittal indicate special requests regarding disposition of sample submittals.

02100.03.06 ENGINEER'S ROLE

Except for submittals for record, information or similar purposes, where action and return are required, the Engineer will review each submittal, mark to indicate action taken and return. Compliance with specified characteristics is the contractor's responsibility. The Engineer will stamp each submittal with a self-explanatory stamp marked to indicate either approval, rejection, conditional approval and comments.

END OF SECTION

LIST OF REQUIRED SUBMITTALS

Borough of Stone Harbor

82nd Street Recreation Facility Tennis Court Building

ITEM	DESCRIPTION	DATE RECEIVED	DATE APPROVED	DATE REJECTED	RESUBMITTED APPROVED DATE
1	Construction Schedule				
2	Concrete Mix Design				
3	Sodding and Topsoil				
4	HDPE Pipe & Fittings				
5	Pre-Construction Video				

AS-BUILT PLANS
SECTION 02120

02120.01 DESCRIPTION
The contractor shall provide a set of reproducible as-built plans prior to final payment. Final payment will not be made until such time the As-Built Plans have been submitted to and approved by the Engineer.

02120.02 MATERIALS
As-builts shall be a reproducible of the original contract plans including any additional sheets required. All deviations from the original contract plans shall be on the as-builts. The plans shall be legible, neat, and of a quality acceptable to the Engineer.

The Engineer shall provide a set of reproducibles at the beginning of the project.

02120.03 CONSTRUCTION
The contractor shall be responsible for keeping the as-built up-to-date as the project progresses.

This section is intended to provide a minimum level of acceptance. Any section with more stringent requirements shall have precedence over this section.

SANITARY SEWER SERVICES
Sewer service connections shall be indicated by distance from the previous upstream manhole and a right or left distance off of the main. Locate the end of the lateral with tie dimensions to two permanent features and indicate depth of burial.

WATER SERVICES
Services shall be indicated by means of triangulation off of the front of the building. If no building exists, then by two permanent features.

SEWER MAINS
Actual distance installed from center of manhole, actual elevations of manholes and rims shall be indicated on the plans. Indicate slope, pipe size and type, and inverts. Plans shall be complete enough for submission to the New Jersey Department of Environmental Protection & Energy.

WATER MAIN AND FORCE MAINS
Actual distance installed, actual inverts at each bend, and high and low points. At each fitting, bend and gate valve, tie dimensions shall be provided to three permanent features.

STORM SEWER
Any change in invert location, grate elevation, pipe size, class, or type, and any utility sleeves shall be indicated on the plans.

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.

END OF SECTION

CLEANING AND RESTORATIONS
SECTION 02130

02130.01 DESCRIPTION

A. Contractor shall provide all equipment, labor & materials required to clean and restore the site to at least the existing condition.

B. Maintain premises and public properties free from accumulations of waste, debris and rubbish caused by work operations.

C. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials; clean all sight exposed surfaces; leave project clean and ready for occupancy.

D. At completion of work, restore or replace, when and as directed by the Engineer, any public or private property disturbed or damaged by Contractor's work operations to a condition at least equal to that existing prior to beginning work, or as otherwise specified. Materials, equipment and methods shall be approved by the Engineer.

02130.02 MATERIALS

A. For restorations, use the following materials. All materials shall comply with the following Articles of the New Jersey Department of Transportation Standard Specifications 2007 Edition and these specifications.

B. Grass restorations: See Section 808 "Sodding".

C. Pavement restorations: See Section 401 Hot Mix Asphalt (HMA) courses.

D. Restoration of curbs and other concrete structures:

1. Concrete:

   a. Shall conform to Section 903.
   b. Compressive Strength: N.J.D.O.T Class "B".
   c. Air-entrained.

2. Joint Fillers: Section 914.01, bituminous cellular type.

3. Curing Compound: Section 903.10, white-pigmented liquid.

E. Driveway Restoration: Driveway Aprons shall be replaced in kind with Portland Cement Concrete, or Hot Mix Asphalt. See Section 606 "Sidewalks, Driveways and Islands".

F. All other Materials: As approved by the Engineer or authorities having jurisdiction.

02130.03 CONSTRUCTION

METHODS OF CONDUCTING WORK - CLEANING

A. Requirements of regulatory agencies: All excess material shall be removed from the site and disposed of by the contractor at his expense. Cost to be & included in the unit price bid for all items. The disposal site shall be in permanently established licensed OSWA (Office of Solid Waste Administration, New Jersey Department of Environmental Protection) landfills.

B. Cleaning during construction: Provide periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish and windblown debris resulting from construction operations.

Provide on-site containers for the collection of waste materials, debris and rubbish. Maintain containers as required.

C. 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 without 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 be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, 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 Owner and charged to the Contractor.

METHODS OF CONDUCTING WORK - RESTORATIONS

A. General: All existing structures, unpaved areas and paved areas disturbed or damaged during the work under this contract shall be restored or replaced to a condition at least equal to that existing prior to beginning work, or as otherwise specified. The methods of conducting this work shall, as a minimum, conform to the following Articles of the New Jersey Department of Transportation Standard Specifications, latest revision.

B. Grass Restorations: See Section 808 "Sodding".

C. Pavement Restorations: The methods of construction employed shall conform to the requirements set forth in the Standard Specifications as applicable to the type of material being utilized.

D. Restorations of Curbs and Other Concrete Structures:

1. Curbs: Section 607
2. Other concrete structures: Restore in accordance with applicable Articles of the Standard Specifications.

E. All Other Restorations: Restore in accordance with applicable Articles of the NJDOT Standard Specifications, or as approved by the Engineer or authorities having jurisdiction.

END OF SECTION

CLEARING SITE
SECTION 02140

02140.01 DESCRIPTION

Refer to Section 201.01 of the N.J.D.O.T. Standard Specifications and the construction plans.

02140.02 MATERIALS

Refer to Section 201.02 of the N.J.D.O.T. Standard Specifications.

02140.03 CONSTRUCTION

Refer to Section 201.03 of the N.J.D.O.T. Standard Specifications.

END OF SECTION

SOIL EROSION AND SEDIMENT CONTROL
SECTION 02200

02200.01 DESCRIPTION

Refer to Section 158.01 of the N.J.D.O.T. Standard Specifications.

02200.02 MATERIALS

Refer to Section 158.02 of the N.J.D.O.T. Standard Specifications.

02200.03 CONSTRUCTION

Refer to Section 158.03 of the N.J.D.O.T. Standard Specifications.

END OF SECTION

TRENCH EXCAVATION AND BACKFILL
SECTION 02220

02220.01 DESCRIPTION

Trench Excavation and backfill shall include clearing and grubbing and excavating and backfilling for all utilities, and all appurtenances at the required locations, as shown on the plans and specifications for all materials of whatsoever nature encountered.

02220.02 MATERIALS

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. Backfill to a height of two (2) feet above the top of the pipes, culverts and other structures with material free from stones or rock fragments larger than two inches (2") in greatest dimension, or as directed by Engineer.

3. Free of large rocks or lumps that, in the opinion of the Engineer, may create voids or prevent proper compaction.

C. Stone for trench stabilization and bedding:

Trench stabilization material for bedding under pipes and structures shall be broken stone conforming to Section 901.03.01 of the NJDOT Standard Specifications, and meeting the gradation specified in Table 901.03-1. Size shall be No. 57.

D. Select backfill (if and where directed) for pipes and for tennis court repairs shall be designated as I-13 and meet all the requirements of Section 901.11 of the NJDOT Standard Specifications and meeting the gradation specified in Table 901.11-1.

02220.03 CONSTRUCTION

A. **General Excavation** - 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 plans, 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 excavated in earth shall be one vertical to two horizontal. 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 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.

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.

B. **Excavating Trenches, etc.** - 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, and any sheathing, shoring, bracing or timbering which is necessary to obtain this result shall be done as hereinafter specified. Sloped banks will not be permitted except where permitted by the Engineer.

The maximum width of trench at top of pipe measured to undisturbed earth shall be:

I.D. of Pipe	Width
8"	2'-3"
12"	2'-7"
15"	2'9"
18"	3'-0"
21"	3'-3"
24"	3'-6"
30"	4'-0"
36"	4-6"
42"	5'6"
48"	6'-0"

Should sloped banks be permitted, contractor shall, at no extra charge to Owner, provide temporary surface over width of disturbed area of street to provide for the unrestricted use of traffic immediately upon completion of backfill. Such temporary surfacing shall be stone, gravel or as required to permit traffic immediately.

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. 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. In case a trench be excavated at any place below given grade excepting at pipe joints, it shall be refilled to the proper grades in the manner hereinafter specified. Unless otherwise specified, all excavation shall be performed by the open cut method.

C. **Unauthorized Excavation** - Special care shall be taken to prevent the movement of disturbances of earth under the foundation of the pipelines, manholes and other structures by providing adequate sheathing and bracing. Where the excavation is carried beyond or below the lines and grades given by the Engineer, or wherever the Engineer shall determine that any material has been loosened or disturbed sufficiently to reduce its supporting power, remove all such loosened material and refill all such excavated space to grade with sand or loam thoroughly rammed, in such manner as may be directed by the Engineer in order to ensure the adequate support and stability of the pipeline and other structures. All excavation and any other operation shall be confined to the width of the right-of-ways available.

D. **Additional Excavation** - If material satisfactory for foundations is not found at the elevation of grade, or in case it is found undesirable or necessary to excavate to additional depth, the excavation shall be carried to such additional depth as the Engineer may direct, and refill with compacted sand, washed stone or washed gravel, by the Contractor at no extra cost to the Owner.

E. **Tunneling** - No tunneling will be allowed except by permit from the Engineer. When tunneling, excavate the materials to cross sections as may be designated by the Engineer.

F. **Amount of Trench to be Opened** - The Engineer shall have the right to limit the amount of trench which shall be opened in advance of the completed pipeline and also the amount of trench left unfilled.

Unless otherwise specified, not more than three hundred feet of trench shall be opened or partly opened at any one time in one operation. Adequate provisions shall be made for the use of cross walks and driveways. Provide and maintain all necessary barricades and lights.

G. **Materials Excavated** - 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 traveling 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.

H. **Removal of Excavated Materials** - 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 site at the Contractor's expense. However, if the Owner has no real need for this excess excavation, or if the material is unsuitable, it shall be the Contractor's responsibility to dispose of said material at no expense to the Owner. The disposal site shall be one approved by the NJDEP.

I. **Shoring and Sheathing** - 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. 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.

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. 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 therefore to the Owner, resulting from the installation of the water mains sewer mains, sewer services and water services or other structures under this contract from the time of completion for a period of two years thereafter to the satisfaction of the Owner.

The Contractor shall be held responsible for the protection of the foregoing described adjacent structures and he alone shall decide upon the advisability of removing any of the sheathing, shoring, bracing or timbering. The Contractor shall, however, 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.

All sheathing and shoring left permanently in the excavation shall be cut out at a point 18" below the ground. 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. **Removal of Water** - Maintain and provide at all times during construction ample means and device which shall promptly remove and properly dispose of all water or sewage entering the excavation and structures, until all work to be built therein is completed.

Dispose of the water from the trenches and excavation in a suitable manner, without damage to adjacent property and in no case unless by special permission of the Engineer, shall water be allowed to run through the new pipes.

Furnish all necessary machinery, power and labor to pump, bail or otherwise remove any water which may be found or shall accumulate in the trenches or other excavation and shall perform all work necessary to keep them clear of water while the work is under construction.

If the ground water and subsoil conditions along the line of the work are such that the Contractor cannot successfully handle the ditch water and provide a stable, hard trench bottom by ordinary trench pumping and bailing, the Contractor shall furnish and provide the necessary equipment, power and labor to employ the well point method of trench dewatering without additional compensation. All pipe, joint and concrete must be installed under absolutely dry conditions.

K. **Backfilling** - 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 the Section.

Should excavated material be clay that will not consolidate by ordinary methods of backfilling, it shall be removed from site and replaced with granular material capable of quick compaction, the cost of said material to be included in the price bid.

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 and at least one man shall be engaged in tamping for each man engaged in shoveling into the trench. At this point on, in trenches and all other excavations, 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.

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 – 93%
3. Pavement, Driveways, & Walkway Areas – 95%

L. **Borrow Fill Material** - Should there be insufficient material (only if and where directed by the Engineer) to provide suitable material for backfilling and embankment, the Contractor, if and where directed by the Engineer, shall obtain such material elsewhere, transport it to the work site and deposit it therein as described in these specifications and shown on the drawings. Borrow materials shall be subject to approval of the Engineer. Borrow shall be free of organic inclusions and shall be gravelly sand or sandy gravel, fairly well graded, and conforming to S203 of the NJDOT Standard Specifications, except as modified by the supplemental requirements below:

1. Containing no rocks or lumps over six inches in greatest dimension.
2. Composed of soil aggregate, or soil aggregate and rock. The portion passing the four inch sieve shall contain not more than fifteen percent (15%) by weight of material passing the number 200 sieve. When composed of soil aggregate and rock, the proportion of soil aggregate shall not be less than that required to fill all the rock voids.

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 - 93%
3. Pavement, driveways & walkway area - 95%

M. **Temporary Trench Finish** - In completing work of backfilling the trench, the material shall be carefully placed to conform to the adjacent street surfaces, allowing, however, a slight crown over the trench area to allow for settlement but not sufficient to prevent the use of the street across the trench area by traffic. As settlement occurs, refill and regrade the temporary trench finish with suitable hard material and continue to maintain the surface until such time as the permanent repaving shall be allowed by the Engineer. Allowance repaving by Engineer shall not relieve Contractor of his responsibility for settlement.
The maintenance of trenches shall be continuous by Contractor in such a manner as to keep all streets passable for both pedestrians and vehicular traffic. Cleanup shall be continuous as work progresses. Contractor shall control any dirt or dust by calcium chloride, etc. as necessary and required at Contractor's expense.

N. **Foundations** - 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.

O. **Interference with Existing Structure or Utilities** - In excavating or backfilling, care must be taken not to injure any gas, water, sewer, electric or telephone conduits or other pipes, conduits or structures. The locations will be made by the Engineer and in locating, he shall avoid interference with existing utilities as far as possible. Contractor shall, at his expense, sling, shore-up and secure and maintain a continuous flow in utilities and shall repair any damage done to them and shall keep them in repair until final acceptance of completed work, leaving them in as good a condition as when uncovered. Where it is either necessary

or advisable to locate existing substructures in advance of or during actual construction of the work, the Contractor shall cooperate with the Engineer and furnish without cost to the Owner such labor and equipment as may be required to locate any existing subsurface utilities or structures. No payment will be made for delays to Contractors due to interference with utilities.

The Contractor shall, in advance of construction, obtain all available information as to location of existing underground utilities, service, etc. and will be held responsible for damage done by him to underground structures injured in construction.

P. **Protection of Street Surfaces** - The Contractor shall carefully plank, or otherwise protect all street surfaces, gutters, curbs, and sidewalks before moving any heavy equipment, machinery, tractor or truck over the same. He will be held fully responsible for all damage of every kind which may be incurred by the various surfaces and the Contractor shall repair or rebuild the surfaces as specified for the various surfaces elsewhere herein the specifications except that no payment will be made by the Owner to the Contractor for repair or rebuilding of the surfaces outside the trench areas. The surfaces repaired shall be equal to or superior to the surfaces damaged.

. **Restoration of Rights-of-Ways, etc.** - Where pipelines are constructed along the rights-of-ways, etc., the same shall be restored to their original condition. Sod, topsoil, flowers and shrubbery, if any, shall be carefully removed and replaced or, if damaged, shall be carefully removed and replaced. Trees shall be protected and suffer no damage. Utility poles shall be adequately braced in accordance with the utilities regulations.

R. **Detours, etc.** - Contractor shall, where necessary, provide and erect all detour signs and maintain necessary barricades and lights. He shall confer with the local police chief and fire chief before blocking any street.

Contractor shall construct temporary bridges in order to provide access to driveways, etc. when required.

S. **State Highways** - Contractor shall fully comply with all regulations of the New Jersey Department of Transportation covering street openings when any work within right-of-way lines of any State Highway right-of-ways or property. Permit shall be secured by the Contractor.

T. **County Roads** - Contractor shall investigate and conform with all regulations of County Department having jurisdiction over street opening when performing any work in County roads. Permits for road opening shall be secured by the Contractor and any inspection services required by County shall be paid for by Contractor.

U. **Railroad Crossings** - Contractor shall fully comply with all regulations of the Railroad Company when performing any work within Railroad right-of-ways. Permits shall be secured by Contractor.

END OF SECTION

DEWATERING
SECTION 02240

02240.01 DESCRIPTION
Installation of a dewatering system in order to construct the various sections of the project where the water table is not workable under ordinary methods and make necessary arrangements to by-pass stormwater and groundwater around the proposed improvement during excavation and trenching.

02240.02 MATERIALS
The Contractor shall be responsible for the type and design of the dewatering system and the methods to by-pass storm and ground water.

02240.03 CONSTRUCTION
Provide and maintain ample means and devices (including spare units for use in case of breakdown) to promptly remove and dispose of water or sewage entering excavations or trenches.

Keep excavations and structures dry until all work is completed, and pipe joints are satisfactorily installed, and to the extent that introduction of water in system will not damage either new or existing structures.

Contractor shall install dewatering system and be responsible for its strength, stability and safety throughout the project.

By-pass or dispose of the water in suitable manner without damage to work site or adjacent property. The contractor shall also be responsible to repair any damages to the existing structures due to his construction.

Provide and maintain ample means and devices (including spare units for use in case of breakdown) to promptly remove and dispose of water or sewage entering excavations or trenches.

Where directed by the Engineer, the Contractor shall provide equipment, power, labor to employ Well Point method of trench dewatering without additional compensation, if groundwater and subsoil conditions along line of work are such that a stable, hard trench or excavation bottom for the pipe or structure cannot be achieved by trench pump, bailing or other methods.

Methods of dewatering shall be in accordance with the requirements of Section 158 Soil Erosion and Sediment Control and Water Quality Control of the NJDOT Standard Specifications.

END OF SECTION

SIDEWALKS AND DRIVEWAYS
SECTION 02290

02290.01 DESCRIPTION
Refer to Section 606.01 "Sidewalks, Driveways and Islands" of the N.J.D.O.T. Standard Specifications and the construction drawings.

02290.02 MATERIALS
Refer to Section 606.02 of the N.J.D.O.T. Standard Specifications.

02290.03 CONSTRUCTION
Refer to Section 606.03 of the N.J.D.O.T. Standard Specifications and the construction drawings.

END OF SECTION

SITE EXCAVATING, FILLING AND GRADING
SECTION 02315

02315.01 DESCRIPTION

A. Description of work: Site excavation, filling and grading includes but is not limited to:

1. Filling and backfilling to attain the indicated finished grades for the entire site.
2. Any additional work as may be specified in the Statement of Work.

B. Definitions:

1. Excavation: Removal and disposal of all material encountered when establishing required grade elevations.
2. Unauthorized excavation: Removal of materials beyond specified subgrade elevations without approval of the Engineer.

02315.02 MATERIALS

A. General: All fill and backfill materials shall be subject to the approval of the Engineer.

B. On-Site Fill: The native soils will be used as fill, however, all on-site materials used for fill shall be subject to the approval of the Engineer, and to the following requirements:

1. Free from organic matter, deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage, glass, plastics, and matter that may decay.

2. Free of large rocks or lumps that, in the opinion of the Geotechnical Engineer, may create voids or prevent proper compaction, free of rubble, bricks, large wood and concrete pieces.

C. Borrow fill material: Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay. The fill material shall consist of well-graded granular soils (sand and gravel) containing less than 12% fines (material passing the No. 200 sieve) and a maximum particle size of 3 inches. All fill shall be compatible with the in-situ soil. The borrow fill material shall be used only when the available on-site material is completely depleted and with the permission of the Engineer.

D. Basin trench material: Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay. The material shall consist of granular soils (sand). All trench material shall meet the gradation requirements shown in section 901.06.02 of the NJDOT Standard Specifications for Road and Bridge Construction, 2007, for natural sand.

E. Notifications: For approval of borrow materials, notify the Engineer at least five (5) working days in advance of intention to import material, designate the proposed borrow area, and perform sampling and testing at Contractor's expense, if directed by the Engineer, to prove the quality and suitability of the material.

02315.03 CONSTRUCTION

A. Requirements of regulatory agencies:

1. All excavations shall be in compliance with Federal Occupational Safety and Health Act and Rules and Regulations of State of New Jersey Department of Labor and Industry, Bureau of Engineering and Safety, N.J.A.C. 12:180.

2. Excavation work shall be in compliance with applicable requirements of other governing authorities having jurisdiction.

3. The contractor may be required to provide soil sampling and testing reports to the waste management facilities in order to dispose of the soil. The contractor will be responsible for this work, and his/her costs shall be included in the unit price bid for the project. Copies of all testing results shall be submitted to the Owner and Engineer prior to the removal of the materials from the site for disposal.

4. A letter of compliance/acceptance from the disposal facility that will accept the soil shall be submitted to the Owner and Engineer prior to the removal of the materials from the site for disposal at the facility.

5. One copy of each waste disposal manifest shall be submitted to the Owner and Engineer after acceptance of the waste at the disposal facility.

B. Reference standards included in this Specification section:

1. New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction Standard Specifications (2007).

   a. Table 901.11-1 Standard Soil Aggregate Gradations

2. American Society for Testing and Materials (ASTM):

   a. D-1556-07: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

   b. D-1557-07: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)

   c. D4253-00(2006): Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

   d. D2166-06: Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

   e. D6938-08a: Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. Test reports:

1. The following test reports shall be made if the borrow fill material is used.

2. One optimum moisture, maximum density curve for each type of soil encountered, including a complete test report as specified in ASTM D-1557.

3. Field Density test reports.

4. Report of actual Unconfined Compressive Strength and/or results of bearing tests for each strata encountered at footing subgrades. The report shall be prepared in accordance with ASTM D-2166.

5. Test reports on all borrow material and select backfill material in accordance with the following standards:

   a. Standard Test Method for Particle-Size Analysis of Soils: ASTM D422 - 63(2007).

   2Bb. Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils: ASTM D4318-05.

D. The following Site Preparation Procedures are recommended:

1. Strip the site from all vegetation and other deleterious material as specified under Section 201 Clearing Site of the 2007 NJDOT Standard Specifications.

2. Refer to Section M-2 for compaction information.

3. Undercut any zones of instability disclosed by proof-rolling and replace the undercut material with fill, as approved by the Engineer.

E. Existing utilities:

1. Should any functioning utilities be encountered during excavation, notify the Engineer immediately and consult the Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Owner.

2. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

3. Demolish and completely remove from site all abandoned, if any, existing underground utilities encountered during excavation.

4. Permit the appropriate utility companies access to the site for the purpose of clearing of the proposed utility easement and the relocation of the existing overhead utility system.

F. Use of explosives: The use of explosives is not permitted.

G. Protection of persons and property:

1. Barricade open excavations occurring as part of this work and post with warning lights as required to protect persons on the site. Operate warning lights as recommended by authorities having jurisdiction.

H. Dust Control:

1. Use all means necessary to control dust on and near the work if such dust is caused by the Contractor's operations during performance of the work or if resulting from the conditions in which the Contractor leaves the site.

2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and concurrent performance of other work on the site.

I. Weather conditions: Do not place, spread, roll or fill material during freezing, raining, or otherwise unfavorable weather conditions. Do not resume work until conditions are favorable as determined by the Engineer.

J. Inspection by Contractor: Examine the areas and conditions under which excavating, filling and grading are to be performed and notify the Engineer, in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

K. Preparation:

1. Prior to commencement of work, establish location and extent of all utilities in the work areas. Maintain, protect as required existing utilities which pass through the work area.

L. Excavation:

1. Unauthorized excavation:

Unauthorized excavation, including remedial work directed by the Engineer, shall be at the Contractor's expense.

2. Additional excavation:

a. When excavation has reached required sub-grade elevations, notify the Engineer who will make an inspection of conditions.

b. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Engineer.

3. Stability of excavations:

a. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space.

b. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

4. Shoring and bracing:

a. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

b. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

c. Exercise care in the drawing and removal of sheeting, shoring, bracing and timbering to prevent collapse and caving of the excavation faces being supported.

5. Dewatering:

a. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding areas.

b. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms and undercutting of footings, and prevent soil changes detrimental to the stability of subgrades and foundations. Provide and maintain cofferdams, pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

6. Material storage:

a. Stockpile satisfactory excavated materials where directed until required for use as backfill or fill. Place, grade and shape stockpiles for proper drainage.

b. Locate and retain soil materials away from edge of excavations.

c. Dispose of excess soil material and waste materials as herein specified. Excavated material unsuitable for backfilling shall be kept separate from other materials excavated, and disposed of. Materials suitable for backfilling shall not be disposed of until completion of filling or back-filling operations.

d. Historic fill material that has been excavated shall be placed on and covered with polyethylene sheeting and shall be removed from the project site by the end of each work day.

M. Backfill, fill and compaction:

1. General:

a. Fill material imported from an off-site source shall be tested prior to construction use, at the Contractor's expense, to determine the suitability of the fill material and standard Proctor parameters. Test reports shall be submitted to the Engineer.

b. Place acceptable material in layers to required subgrade elevations.

c. Fills: Use material obtained from on-site excavation, except use borrow material when specified and/or shown on the Plans.

d. Do not provide borrow material until all acceptable excavated materials on the site have been utilized in the work.

e. Place the various types of materials in the areas as designated on the Plans, or as directed by the Engineer.

2. Ground Surface Preparation, Placement and Compaction:

Following the necessary cuts to grade the site, all of the exposed subgrades shall be proof-rolled and densified until at least 95 percent of the Modified Maximum Dry Density, ASTM D-1557, is obtained. The proof –rolling and compaction should be performed using a large vibratory roller with a static weight of at least 10 tons. The proof-rolling and compaction operations should be performed during dry and favorable weather period in the presence of the Engineer. A minimum of eight overlapping passes should be performed. The vibratory function of the roller should not be used within 20 feet of any existing structure and the roller should be used in static mode in these areas. Any structural fill placement which is required below the foundation level shall extend a minimum distance of 10 feet beyond the foundation line and at least one foot above the footing sub-grade elevation. Above this elevation, the distance of the structural fill placement beyond the footing line may be reduced accordingly, if required. The moisture content of the fill material should be controlled to within 2% of the optimum moisture content.

All loose areas detected during the densification operation shall be corrected. Correcting shall consist of either (a) excavation of the soft area in those cases where the materials encountered are unsuitable, or too wet to be compacted; or (b) if the moisture content is adequate, densifying the exposed materials. After the proof rolling and densification process is completed, the Engineer's representative will authorize the placement of fill.

Any imported fill required to grade the site shall consist of well-graded granular soils (sand and gravel) containing less than 12 percent fines (material passing the No. 200 sieve) with a maximum particle size of three (3") inches.

All fills should be placed in nine (9") inch layers in loose thickness and shall be compacted to at least the following densities, expressed as a percent of the Maximum Modified Density, ASTM D-1557:

Below Foundations:	95%
Below Slabs:	95%
Below Pavements:	95%
Backfill of Retaining Walls:	95%
Remaining Areas:	90%

The contractor shall provide soil moisture density tests in order to determine the optimum moisture content required to obtain the above specified densities. Where required, the contractor shall modify the in-place soil moisture contend so as to ensure that the above specified densities are obtained.

3. Moisture control:

   a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

   b. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

   c. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

4. Puddling or jetting will not be permitted.

5. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice, or other unsuitable materials.

N. Grading:

1. General:

   Uniformly grade areas as shown in the proposed site plan, including adjacent transition areas. Smooth finish surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

2. Grading surface of materials under proposed structures and all other areas as shown in plans:

Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a ten foot (10') straight edge.

3. Compaction:

   After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

4. Treatment after grading:

   a. After grading is completed and the Engineer has finished his inspection, permit no further excavating, filling or grading except with the approval of and inspection of the Engineer.

   b. Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

O. Field quality control:

1. Quality control testing: Allow testing service to inspect and approve fill layers after grading work is completed. The contractor will supply and pay for the testing service.

2. If in the opinion of Engineer based on testing service reports, subgrade or fills which have been placed are below specified density, the contractor shall provide additional compaction and testing as directed by the Engineer, at no expense to the Owner. This shall include compaction and testing at areas initially tested and at other locations as directed.

   a. Perform in-place field density tests in accordance with ASTM D-1556-07 (Sand Cone Method), or ASTM D-6938-08a (Nuclear Method).

   b. Footing Subgrade: At footing subgrades, at least one (1) test of each soil type to verify design bearing capacities. Subsequent verification and approval by the Engineer of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata.

   c. Pavement & Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) field in-place density test for every 2,000 sq ft (186 sq. m) or less of paved area or slab, but in no case fewer than three (3) tests.

   d. Foundation Wall Backfill: In each compacted backfill layer, at least one (1) field in-place density test for each 100 ft (30 m) or less of wall length, but no fewer than two (2) tests along a wall face.

e. Trench Backfill: In each compacted initial and final backfill layer, at least one (1) field in-place density test for each 150 ft (45 m) or less of trench, but no fewer than two (2) tests.

f. Any other locations as directed by the Engineer.

P. Maintenance:

1. Protection of graded areas:

a. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

b. Repair and re-establish grades in settled, eroded and rutted areas in specified tolerances.

2. Reconditioning compacted areas:

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

Q. Disposal of excess and waste materials:

1. Removal to designated areas on Owner's property:

Transport acceptable excess excavated material to designated soil storage areas on the Owner's property, should the owner wish to retain the material. Stockpile soil or spread as directed by the Engineer.

2. Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off the Owner's property.

3. Under no circumstances shall the contractor remove excess acceptable/useable fill material from the site.

4. The Contractor is responsible for all coordination with the disposal facility. The Contractor is required to manage, excavate, stockpile, store, handle, manifest, haul, classify and dispose of the material in accordance with all Federal, State, and Local requirements. Testing of materials required by the selected disposal facility prior to disposal shall be accomplished by the Contractor at his/her own expense. Only NJDEP certified laboratories shall be used for testing. All sampling shall be done in accordance with the applicable NJDEP guidance manuals and regulations.

5. All waste haulers used by the Contractor shall be currently licensed and registered. The Contractor will identify to the Owner and Engineer in writing, the name and address of any haulers and disposal facilities, at least 2 weeks prior to disposal of wastes.

END OF SECTION 02315

WATER SERVICE LINE (COPPER)
SECTION 02622

02622.01 DESCRIPTION

Furnish and Install new water service lines, including all necessary adjustments to make complete connection as specified herein and where shown on the plans or as directed by the Engineer.

02622.02 MATERIALS

A. Acceptable Manufacturers:

1. The products of Ford Company and as specified in the following paragraphs, are used to establish standards of quality. Other manufacturers' materials may be used provided they are approved as an equivalent product.

B. Curb Valves:
Ford Corp. Type F1000-4-CTS (1" Service)
Ford Corp. Type FB1000-CTS-7 (2" Service)

C. Yokes:
Ford Yoke Bar
Type Y502 (3/4" Service)

Ford Yoke Bar
Type Y504 (1" Service)

D. Check Valves:
Ford Check Valve Type
HS11-333 (3/4" Service)

Ford Check Valve Type
HS11-444 (1" Service)

Ford Check Valve Type
HS11-777 (2" Service)

E. Corporation Stops:
Ford Curb Stop Type B11-444
(1" Service)

Ford Curb Stop Type B11-777
(2" Service)

F. Seamless Copper water tube: ASTM B88-77 Type K annealed, furnished straight or in coils.

G. Fittings: Cast Bronze fittings for flared copper tubes: ANSI-B16.26, latest edition.

H. Meter Box:
Meter Box:
Midstate, 24" x 30" (1" Service)
Midstate, 30" x 30" (2" Service)

02622.03 CONSTRUCTION

A. Installation

1. Workmanship:

a. Examine pipe, fittings, curb boxes and valves before installation to assure no defective materials are incorporated.

2. Placement:

a. Lay piping on firm bed for entire length of trench except where supports are otherwise provided.
b. Employ partial backfilling and cradling to hold pipe in secure position during backfilling operations.
c. Backfill evenly on both sides of pipe to maintain equipment.
d. Anchor piping laid on grade prior to embedment in concrete.
e. Install pipe at 90 degrees to the water main.

3. Bending pipe:

a. Bend pipe by any method to any radius within manufacturer's recommendations.
b. Only bend surface free of cracks and buckles.

B. Curb valves and boxes:

1. Install curb valves and boxes in accordance with the manufacturer's printed instructions and in a manner to allow proper operation of the valve. Assure that valves are installed in the proper direction and that boxes are installed plumb.

2. Install valves and boxes in the locations shown on the plans.

C. Testing:

1. Disconnect all equipment and devices which may be damaged by test pressures.
2. Plug or cap lines.
3. Test and disinfect each piping system.
4. Repair all leaks.

END OF SECTION

HDPE SANITARY SEWER FORCE MAIN & FITTINGS
SECTION 02627

02627.01 DESCRIPTION

A. Furnish and install HDPE (High Density Polyethylene) Piping and Fittings as shown on the drawings and specified herein. Installation method shall be open cut excavation.

SUBMITTALS

A. Certifications: Submit copies of manufacturer's certified letter stating that pipe or joint materials ordered meets requirements of this specification. Letter shall indicate compliance with appropriate reference standards listed.

B. Submittals: Shall meet the requirements of Section 02100 Site Submittals.

QUALITY ASSURANCE/QUALITY CONTROL

A. QUALIFICATION OF MANUFACTURERS: Manufacturer's production facilities shall be open for inspection by the Borough or his designated agents. During inspection, the manufacturer shall demonstrate that he has facilities capable of manufacturing the pipe and fittings required by this specification, that a quality control program meeting the minimum requirements specified in ASTM F-714 is in place, and that facilities for performing the tests required by this specification are available.

   The manufacturer shall certify that the material supplied meets the specifications and that samples of his production pipe have undergone stress regression testing, evaluation, and validation in accordance with ASTM D-2837 and PPI TR-3.

B. The operator of the butt fusion welding equipment and all other pipe joining systems (Electro-fusion, MJ transition, etc.), as well as the installation company shall possess at least three (3) years of experience joining HDPE.

C. In addition, the services of an authorized representative of the pipe manufacturer shall be retained to inspect and certify the quality of the pipe joining system equipment and the operator of the equipment.

D. All pipe materials delivered to the site shall be inspected twice. The first inspection shall occur at the time of delivery of the material to the site, prior to unloading. The second level of inspection should occur prior to the time of joint fabrication. These inspections will determine the presence of soil, grit, inorganic contaminants, organic contaminants, identify transport and/or storage damage to pipe walls or ends, presence of a completed set of components and appurtenances, presence of required labeling and documentation, compliance with on-site storage criteria, and verification of the HDPE material, DR, pipe size and supplier.

E. Replace all materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner and acid solder.

F. Joining and visual inspection of the pipe using a butt fusion method shall be in accordance with PPI publication TR-33 as modified for site specific conditions by the pipe manufacturer.

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 - CAPE MAY

Craft: Air Conditioning & Refrigeration - Service and Repair **PREVAILING WAGE RATE**

	03/01/18
Journeyman (Mechanic)	W37.98 B23.93 T61.91

Craft: Air Conditioning & Refrigeration - Service and Repair **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
As Shown	Mo. 1-3	Mo. 4-12	2nd Year	3rd Year	4th Year	5th Year		Wage = %	of Jnymn	Wage
Wage and Bene	50%	55%	60%	65%	75%	85%		Bene = %	of Jnymn	Bene

Ratio of Apprentices to Journeymen - 1:4

APPRENTICE RATE SCHEDULE FOR THOSE APPRENTICES ENTERING PROGRAM AFTER 3-1-13:

INTERVAL	PERIOD AND RATES					
As Shown	1st Year	2nd Year	3rd Year	4th Year	5th Year	Wage =% of Jnymn Wage
Wage and Benefit	40%	50%	60%	70%	80%	Bene. =% of Jnymn Wage

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 - CAPE MAY

Craft: Boilermaker **PREVAILING WAGE RATE**

	01/01/18
Foreman	W49.50 B42.52 T92.02
General Foreman	W51.50 B43.50 T95.00
Journeyman	W44.50 B40.92 T85.42

Craft: Boilermaker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1000 Hours	65%	70%	75%	80%	85%	90%	95%			
Benefit =	34.83	35.70	36.58	37.44	38.32	39.19	40.05			

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 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 7½ 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 throu Thursday at straight time. Friday may be used as a make-up day for a day lost to inclement weather, holiday or oth 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 - CAPE MAY

Craft: Boilermaker - Minor Repairs **PREVAILING WAGE RATE**

	01/01/18
Foreman	W33.54 B16.17 T49.71
General Foreman	W34.04 B16.17 T50.21
Mechanic	W32.04 B16.17 T48.21

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).

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 o 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 - CAPE MAY

Craft: Bricklayer, Stone Mason **PREVAILING WAGE RATE**

	05/01/18
Deputy Foreman	W45.20 B33.03 T78.23
Foreman	W48.20 B33.03 T81.23
Journeyman	W42.20 B33.03 T75.23

Craft: Bricklayer, Stone Mason **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	50%	55%	60%	65%	70%	75%	80%		
Benefits	3.80	4.75	5.23	5.70	21.16	22.55	23.95	25.33		

Ratio of Apprentices to Journeymen - 1:5

Craft: Bricklayer, Stone Mason **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE AS OF 5-1-18:

INTERVAL	PERIOD AND RATES							
6 Months	40%	50%	55%	60%	65%	70%	75%	80%
Benefits	3.86	4.83	5.31	5.80	21.83	23.27	24.72	26.15

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.

)VERTIME:
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, 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 - CAPE MAY

Craft: Carpenter **PREVAILING WAGE RATE**

	05/01/18	11/01/18
Foreman	W56.02 B31.94 T87.96	W0.00 B0.00 T88.54
Journeyman	W48.71 B27.77 T76.48	W0.00 B0.00 T77.73

Craft: Carpenter **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	40%	55%	65%	80%	90%					
Benefit	57% of	Appren	tice	Wage Rate	for all	intervals				

Ratio of Apprentices to Journeymen - 1:3

Craft: Carpenter **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 7:00 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.

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, 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 - CAPE MAY

Craft: Carpenter - Resilient Flooring **PREVAILING WAGE RATE**

	05/01/18	11/01/18
Foreman	W56.02 B31.94 T87.96	W0.00 B0.00 T88.54
Journeyman	W48.71 B27.77 T76.48	W0.00 B0.00 T77.73

Craft: Carpenter - Resilient Flooring **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	40%	55%	65%	80%	90%					
Benefits	57% of	Appren	tice	Wage Rate	for all	intervals				

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**

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 15%.
- 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 15% and the third shift shall receive the regular wage rate plus 20%.
- 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 15% and the third shift shall receive the regular wage rate plus 20%.

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 p at time and one-half the wage 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 will be observed the following Monday.

County - CAPE MAY

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 - CAPE MAY

Craft: Diver **PREVAILING WAGE RATE**

	05/01/18
Diver	W52.14 B34.57 T86.71
Tender	W43.45 B34.57 T78.02

Craft: Diver **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1500 hours	40%	60%	80%							
Benefits	21.05	23.78	26.50							

Ratio of Apprentices to Journeymen - 1:4

Craft: Diver **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE FOR THOSE APPRENTICES ENTERING PROGRAM ON OR AFTER 12-1-16:

INTERVAL	PERIOD AND RATES			
1500 hours	40%	50%	65%	80%
Benefits	21.05	22.42	24.47	26.50

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, Washington's Birthday, 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 - CAPE MAY

Craft: Dockbuilder **PREVAILING WAGE RATE**

	05/01/18
Foreman	W52.14 B34.57 T86.71
Journeyman	W43.45 B34.57 T78.02

Craft: Dockbuilder **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1500 hours	40%	60%	80%							
Benefits	21.05	23.78	26.50							

Ratio of Apprentices to Journeymen - 1:4

Craft: Dockbuilder **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE FOR THOSE APPRENTICES ENTERING PROGRAM ON OR AFTER 12-1-16:

INTERVAL	PERIOD AND RATES			
1500 hours	40%	50%	65%	80%
Benefits	21.05	22.42	24.47	26.50

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.

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, Washington's Birthday, 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 - CAPE MAY

Craft: Drywall Finisher **PREVAILING WAGE RATE**

	05/01/17
Foreman	W43.45 B23.60 T67.05
General Foreman	W45.43 B23.60 T69.03
Journeyman	W39.50 B23.60 T63.10

Craft: Drywall Finisher **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
4 Months	30%	40%	50%	60%	70%	75%	80%	85%	90%	
Benefits	Intervals	1 to 3 =	9.85	Intervals	4 to 6 =	12.28	Intervals	7 to 9 =	14.95	

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 - CAPE MAY

Craft: Electrician **PREVAILING WAGE RATE**

	10/02/17	10/01/18
Asst. General Foreman	W55.86 B47.14 T103.00	W0.00 B0.00 T104.71
Foreman	W52.14 B44.27 T96.41	W0.00 B0.00 T98.23
General Foreman	W60.52 B50.74 T111.26	W0.00 B0.00 T112.81
Journeyman, Cable Splicer	W46.55 B39.97 T86.52	W0.00 B0.00 T88.52
Lead Foreman	W53.53 B45.34 T98.87	W0.00 B0.00 T100.65
Working Foreman, Welder, Crane Operator (all types)	W48.88 B41.75 T90.63	W0.00 B0.00 T92.56

Craft: Electrician **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	14.93	19.16	23.40	27.63	31.87					
Benefits	7.25	8.46	9.69	10.90	12.13					

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%

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 regular rate, per hour, inclusive of benefits.
- 3rd Shift (12:30 AM to 8:00 AM): 8 hrs. pay for 7 hrs. work + an additional 15% of the regular rate, per hour, 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 - CAPE MAY

Craft: Electrician - Teledata (15 Voice/Data Lines & Less) **PREVAILING WAGE RATE**

	01/02/18
Master Technician/Gen. Foreman (31+ Workers on Job)	W47.82 B33.95 T81.77
Senior Technician/Lead Foreman (21-30 Workers on Job)	W43.25 B32.45 T75.70
Technician A/Foreman (11-20 Workers on Job)	W41.15 B31.76 T72.91
Technician B/Working Foreman (4-10 Workers on Job)	W39.89 B30.36 T70.25
Technician C/Journeyman (1-3 Workers on Job)	W36.00 B28.08 T64.08

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	8.95	8.95	9.92	9.92	11.87	11.87	14.22	14.22		

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%

SHIFT DIFFERENTIAL:
- 2nd Shift (4:30 PM to 12:30 AM) - 8 hrs. pay for 7.5 hrs. work + an additional 10% of the regular hourly rate, per hour.
- 3rd Shift (12:30 AM to 8:00 AM) - 8 hrs. pay for 7 hrs. work + an additional 15% of the regular 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, 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.

County - CAPE MAY

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 - CAPE MAY

Craft: Electrician- Outside Commercial **PREVAILING WAGE RATE**

	10/02/17	10/01/18
Assistant General Foreman	W55.86 B46.91 T102.77	W0.00 B0.00 T104.47
Foreman	W52.14 B44.01 T96.15	W0.00 B0.00 T97.96
General Foreman	W60.52 B50.53 T111.05	W0.00 B0.00 T112.61
Groundhand, Truck Driver, Conduit Installer (1 year or less experience)	W18.62 B1.01 T19.63	W0.00 B0.00 T23.33
Groundhand, Truck Driver, Conduit Installer (1 year or more experience)	W23.28 B21.57 T44.85	W0.00 B0.00 T47.59
Groundhand, Truck Driver, Conduit Installer (2 years or more experience)	W32.59 B28.81 T61.40	W0.00 B0.00 T63.84
Groundhand, Truck Driver, Conduit Installer (3 years or more experience)	W39.57 B34.24 T73.81	W0.00 B0.00 T76.04
Journeyman Lineman	W46.55 B39.67 T86.22	W0.00 B0.00 T88.21
Lead Foreman	W53.53 B45.10 T98.63	W0.00 B0.00 T100.40
Working Foreman	W48.88 B41.48 T90.36	W0.00 B0.00 T92.27

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	9.99	10.61	11.24	11.86	12.49	13.11	13.73			

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 regular rate per hour, inclusive of benefits.
3rd Shift (12:30 AM to 8:00 AM): 8 hrs. pay for 7 hrs. work + an additional 15% of the regular rate per hour, 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 - CAPE MAY

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	67% 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 - CAPE MAY

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	28.24	30.60	32.95	35.30	37.66	40.01	42.36			
Benefits	24.29	25.67	27.03	28.40	29.77	31.13	32.51			

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 - CAPE MAY

Craft: Elevator Constructor **PREVAILING WAGE RATE**

	01/01/18
Helper-Over 5 Years	W39.03 B36.12 T75.15
Helper-Under 5 Years	W39.03 B35.34 T74.37
Mechanic (Journeyman) over 5 years	W55.76 B37.46 T93.22
Mechanic (Journeyman) under 5 years	W55.76 B36.34 T92.10
Mechanic in Charge (Foreman) over 5 years	W62.73 B38.01 T100.74
Mechanic in Charge (Foreman) under 5 years	W62.73 B36.76 T99.49
Probationary Helper (1st 6 months)	W27.88 B34.67 T62.55

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 of 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**

The total number of helpers and apprentices shall not exceed the number of
echanics on the job, except that on jobs where two teams are working, 1 extra helper or apprentice may be employed for he first two teams and an extra helper or apprentice for each additional three 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.

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 - CAPE MAY

Craft: Glazier **PREVAILING WAGE RATE**

	06/07/18
Foreman	W46.32 B32.33 T78.65
Journeyman	W43.32 B32.33 T75.65

Craft: Glazier **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	18.50	22.75	27.75	35.00						
Benefits	17.19	18.98	20.09	21.82						

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 = $39.65/hr.
  Double time = $46.97/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 - CAPE MAY

Craft: Heat & Frost Insulator **PREVAILING WAGE RATE**

	07/07/17	07/01/18	07/01/19	07/01/20
Foreman	W43.32 B33.93 T77.25	W0.00 B0.00 T80.00	W0.00 B0.00 T83.75	W0.00 B0.00 T87.00
Journeyman	W42.32 B33.93 T76.25	W0.00 B0.00 T79.00	W0.00 B0.00 T82.25	W0.00 B0.00 T85.50

Craft: Heat & Frost Insulator **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	45%	55%	65%	75%	80%					
Benefit	30.68	for	all	intervals						

Ratio of Apprentices to Journeymen - *

* Ratio = 1:4 on a "company-wide" basis (i.e. the total number of apprentices and journeymen employed by the company). There is no limit to the number of apprentices allowed on any one job, provided there is at least 1 journeyman on the job.

Craft: Heat & Frost Insulator **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- If there is only 1 Insulator on the job, he must be designated a Foreman.
- If ther are 2 to 10 Insulators on the job, 1 must be designated a Foreman.
- If there are 11 or more Insulators on the job, 1 must be designated a General Foreman and receive the following additional pay (% above Journeyman wage rate):
  11 - 20 Insulators on site: 10%; 21 - 30 Insulators on site: 15%;
  31 - 40 Insulators on site: 20%; 41 - 50 Insulators on site: 25%

The regular workday shall be 8 hours between 7:00 AM and 3:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of two (2) consecutive days and a minimum of two (2) shifts per day must be worked. Additionally, no less than two (2) employees may work on any one (1) shift. If these requirements are not met then shift work would not apply and the applicable overtime rate shall be paid.
- 1st Shift (8:00 AM- 4:00 PM).
- 2nd Shift (4:00 PM - 12:00 AM): additional 15% of the regular rate, inclusive of benefits.
- 3rd Shift (12:00 AM - 8:00 AM): additional 20% of the regular rate, inclusive of benefits.

OVERTIME:
- Hours in excess of 8 per day, or before or after the regular workday Monday through Friday, that are not shift work, 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, Veterans' Day, Presidential Election Day, Thanksgiving Day, 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 - CAPE MAY

Craft: Heat & Frost Insulator - Asbestos Worker **PREVAILING WAGE RATE**

	07/07/17	07/01/18	07/01/19	07/01/20
Foreman	W43.32 B33.93 T77.25	W0.00 B0.00 T80.00	W0.00 B0.00 T83.75	W0.00 B0.00 T87.00
Journeyman	W42.32 B33.93 T76.25	W0.00 B0.00 T79.00	W0.00 B0.00 T82.25	W0.00 B0.00 T85.50

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 materials/asbestos from mechanical systems, includin containment erection and demolition, and placing material in appropriate containers.

FOREMAN REQUIREMENTS:
- If there is only 1 Asbestos Worker on the job, he must be designated an Abatement Foreman.
- If there are 2 to 10 Asbestos Workers on the job, 1 must be designated an Abatement Foreman.
- If there are 11 or more Asbestos Workers on the job, 1 must be designated a General Foreman and receive the following additional pay (% above Abatement Mechanic wage rate):

11 - 20 Insulators on site: 10%; 21 - 30 Insulators on site: 15%;
31 - 40 Insulators on site: 20%; 41 - 50 Insulators on site: 25%

MECHANIC-TO-APPRENTICE RATIO:
- Maximum of 5 Apprentices for each Abatement Mechanic on the job.

OVERTIME:
- Hours in excess of 8 per day, 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, Veterans' Day, Presidential Election Day, Thanksgiving Day, 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 - CAPE MAY

Craft: Ironworker **PREVAILING WAGE RATE**

	07/14/17
Foreman: Building Reinforcing (Rebar)	W52.34 B29.96 T82.30
Foreman: Fence & Guardrail	W49.80 B29.96 T79.76
Foreman: Heavy & Highway Reinforcing (Rebar)	W51.36 B29.96 T81.32
Foreman: Structural Building	W53.42 B29.96 T83.38
Foreman: Structural Heavy & Highway	W52.44 B29.96 T82.40
Journeyman: Building Reinforcing (Rebar)	W48.46 B29.96 T78.42
Journeyman: Fence & Guardrail	W46.11 B29.96 T76.07
Journeyman: Heavy & Highway Reinforcing (Rebar)	W47.56 B29.96 T77.52
Journeyman: Structural Building	W49.46 B29.96 T79.42
Journeyman: Structural Heavy & Highway	W48.56 B29.96 T78.52

Craft: Ironworker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	60%	65%	70%	75%	80%	85%	90%	95%		

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**

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 7:00 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.

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:
  When wages are time and one-half, benefits = $34.07.
  When wages are double, benefits = $38.17.

RECOGNIZED HOLIDAYS: New Year's Eve, New Year's Day, Memorial Day, July 4th, Labor Day, General and Presidential Election Day, Thanksgiving Day, Christmas Eve, Christmas Day. Saturday holidays observed the precedin Friday. Sunday holidays observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAPE MAY

Craft: Laborer - Asbestos & Hazardous Waste Removal **PREVAILING WAGE RATE**

	01/26/17
Journeyman (Handler)	W30.88 B21.91 T52.79

Craft: Laborer - Asbestos & Hazardous Waste Removal **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	18.53	21.62	24.70	27.79						
Benefit	20.26	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, Good Friday, Easter, Memorial Day, July 4th, Labor Day, Presidential Election 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 - CAPE MAY

Craft: Laborer - Building **PREVAILING WAGE RATE**

	05/15/18
Class A Journeyman	W33.45 B29.12 T62.57
Class B Journeyman	W32.95 B29.12 T62.07
Class C Journeyman	W28.01 B29.12 T57.13
Foreman	W37.63 B29.12 T66.75
General Foreman	W41.81 B29.12 T70.93

Craft: Laborer - Building **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	60%	70%	80%	90%						
Benefit	25.87	25.87	25.87	25.87						

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 f 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%.

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, 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 - CAPE MAY

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	19.53	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.

Craft: Laborer - Heavy & General **COMMENTS/NOTES**

As of 3-1-18, benefits shall be $20.23.
As of 9-1-18, benefits shall be $20.28.
As of 3-1-19, benefits shall be $21.03.
As of 3-1-20, benefits shall be $21.78.

Heavy & General Laborer rates are located in the "Statewide" rate package.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAPE MAY

Craft: Laborer-Residential and Modular Construction **PREVAILING WAGE RATE**

	04/26/18
* Skilled Tradesman (only applies to Modular Construction)	W25.85 B5.45 T31.30
Foreman (person directing crew, regardless of his skill classification)	W29.85 B5.45 T35.30
Laborer	W21.85 B5.45 T27.30
Laborer (for single family and stand-alone duplex owned by single owner)	W16.35 B2.95 T19.30

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, includimg basement levels. Please note the construction must be residential in nature for ALL FLOORS at an elevation of no more than FOUR (4) FLOORS, INCLUDING BASEMENT. 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 in ature for ALL STORIES at an elevation of no more than FOUR (4) STORIES. 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 - CAPE MAY

Craft: Millwright **PREVAILING WAGE RATE**

	05/01/18
Foreman	W56.12 B33.14 T89.26
Journeyman	W48.80 B28.90 T77.70

Craft: Millwright **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	45%	50%	55%	60%	65%	70%	75%	85%	95%
Benefits	58% of	Appren	tice	Wage	Rate	for all	intervals	+ $.60		

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.
- When there are 21 or more Millwrights on a job, 2 shall be designated as Foremen.

The regular workday shall consist of 8 hours, starting between 7:00 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.

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, 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 - CAPE MAY

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 - CAPE MAY

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 - CAPE MAY

Craft: Painter - Bridges **PREVAILING WAGE RATE**

	05/04/17
Foreman	W59.13 B27.67 T86.80
General Foreman	W61.13 B27.67 T88.80
Journeyman	W54.13 B27.67 T81.80

Craft: Painter - Bridges **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	50%			60%	70%		80%	90%	
Benefits	Intervals	1 to 2 =	8.88	Intervals	3 to 4 =	10.81	Intervals	5 to 6 =	13.48	

Ratio of Apprentices to Journeymen - 1:4

Craft: Painter - Bridges **COMMENTS/NOTES**

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.
- 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, Presidential Election Day, Veterans' Day, Thanksgiving Day, Christmas Day. Saturday holiday observed the preceding Friday. Sunday holida observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAPE MAY

Craft: Painter - Line Striping **PREVAILING WAGE RATE**

	12/01/17
Apprentice (1st year)	W25.45 B11.00 T36.45
Apprentice (2nd year)	W29.45 B18.00 T47.45
Foreman (Charge Person)	W37.60 B18.17 T55.77
Journeyman 1 (at least 1 year of working exp. as a journeyman)	W33.33 B18.17 T51.50
Journeyman 2 (at least 2 years of working exp. as a journeyman)	W37.10 B18.17 T55.27

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 - CAPE MAY

Craft: Painter - New Construction **PREVAILING WAGE RATE**

	05/17/18	05/01/19	05/01/20
Foreman	W43.80 B24.35 T68.15	W45.45 B24.35 T69.80	W47.45 B24.35 T71.80
General Foreman	W47.78 B24.67 T72.45	W49.43 B24.67 T74.10	W51.43 B24.67 T76.10
Journeyman	W39.82 B24.04 T63.86	W41.47 B24.04 T65.51	W43.47 B24.04 T67.51

Craft: Painter - New Construction **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	40%	45%	55%	65%	70%	75%	80%	80%		
Benefits	8.05	8.05	10.05	10.05	11.05	11.05	14.05	14.05		

Ratio of Apprentices to Journeymen - 1:4

Craft: Painter - New Construction **COMMENTS/NOTES**

Spraying, sandblasting, lead abatement, work on tanks or stacks, 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 D Veterans' Day, Thanksgiving Day, Christmas Day.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAPE MAY

Craft: Painter - Repainting **PREVAILING WAGE RATE**

	05/17/18	05/01/19	05/01/20
Foreman	W32.27 B19.91 T52.18	W33.07 B19.95 T53.02	W33.92 B19.95 T53.87
General Foreman	W35.20 B20.06 T55.26	W36.00 B20.10 T56.10	W36.85 B20.10 T56.95
Journeyman	W29.34 B19.77 T49.11	W30.14 B19.77 T49.91	W30.99 B19.77 T50.76

Craft: Painter - Repainting **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	PAINTER	NEW	CONSTR UC	TION					

Ratio of Apprentices to Journeymen - 1:4

Craft: Painter - Repainting **COMMENTS/NOTES**

NOTE: These rates may only be used on jobs where no major alterations (only doing painting and carpeting with nothing else being changed in the office or on the project) occur, and where not more than 3 other trades are present on the job, but may NOT, under any circumstances, be used for work on bridges, stacks, elevated tank, or generating stations.

Spraying, sandblasting, lead abatement, work on tanks or stacks, 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.

OVERTIME:
- Hours in excess of 8 per day and 40 per week 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.
- Four 10-hour days may be worked, at straight time, Monday through Sunday.

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 - CAPE MAY

Craft: Painter- Containment **PREVAILING WAGE RATE**

	05/04/17
Journeyman	W35.18 B24.75 T59.93

Craft: Painter- Containment **COMMENTS/NOTES**

NOTE: These rates shall require no painting, but used in a supporting capacity only, such as wrapping, boxing, fencing, etc. on tanks.

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..
- 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, 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 - CAPE MAY

Craft: Painter-Elevated Water Tanks **PREVAILING WAGE RATE**

	05/04/17
Foreman	W48.92 B24.92 T73.84
General Foreman	W50.92 B24.92 T75.84
Journeyman	W43.92 B24.92 T68.84

Craft: Painter-Elevated Water Tanks **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	PAINTER	BRIDGES							

Craft: Painter-Elevated Water Tanks **COMMENTS/NOTES**

These rates apply to: All new and repaint elevated 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.
- 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, 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 - CAPE MAY

Craft: Painter-Structural Steel **PREVAILING WAGE RATE**

	05/04/17
Foreman	W47.87 B25.27 T73.14
General Foreman	W49.87 B25.27 T75.14
Journeyman	W42.87 B25.27 T68.14

Craft: Painter-Structural Steel **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	PAINTER	BRIDGES							

Craft: Painter-Structural Steel **COMMENTS/NOTES**

These rates apply to: All work in power plants (any aspect). On steeples, on dams, on hangers, transformers, substations, etc. and on open steel, whether new or repaint. All new work (excluding traditional commercial painting work) 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.
- 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, 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 - CAPE MAY

Craft: Paperhanger - New Construction **PREVAILING WAGE RATE**

	05/17/18	05/01/19	05/01/20
Foreman	W45.82 B24.11 T69.93	W46.75 B24.11 T70.86	W47.68 B24.11 T71.79
Journeyman	W40.75 B24.11 T64.86	W41.68 B24.11 T65.79	W42.61 B24.11 T66.72

Craft: Paperhanger - New Construction **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
	SEE	PAINTER	NEW	CONSTR UC	TION					

Ratio of Apprentices to Journeymen - 1:4

Craft: Paperhanger - New Construction **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.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAPE MAY

Craft: Paperhanger - Renovation **PREVAILING WAGE RATE**

	05/17/18	05/01/19	05/01/20
Foreman	W33.11 B19.81 T52.92	W34.13 B19.81 T53.94	W35.15 B19.81 T54.96
Journeyman	W30.10 B19.81 T49.91	W31.03 B19.81 T50.84	W31.96 B19.81 T51.77

Craft: Paperhanger - Renovation **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
		SEE	PAINTER	NEW	CONSTR UC	TION				

Ratio of Apprentices to Journeymen - 1:4

Craft: Paperhanger - Renovation **COMMENTS/NOTES**

NOTE: These rates may only be used on jobs where no major alterations occur, and where not more than 3 other trades are present on the job, but may NOT, under any circumstances, be used for work on bridges, stacks, elevated tanks, or generating stations.

FOREMEN REQUIREMENTS:
- When there are 4 or more Paperhangers on a job, 1 shall be designated a Foreman.

OVERTIME:
- Hours in excess of 8 per day and 40 per week shall be paid at time and one-half the regular rate.
- Four 10-hour days may be worked, at straight time, Monday through Sunday.

County - CAPE MAY

Craft: Pipefitter **PREVAILING WAGE RATE**

See "Plumber" Rates

Craft: Pipefitter **COMMENTS/NOTES**

*** See PLUMBER Rates***

County - CAPE MAY

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 - CAPE MAY

Craft: Plumber **PREVAILING WAGE RATE**

	05/01/18
Foreman	W48.04 B43.14 T91.18
Journeyman	W43.67 B43.14 T86.81

Craft: Plumber **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 Months	35%	40%	50%	55%	60%	65%	70%	75%	80%	85%
Benefits										39.87

Ratio of Apprentices to Journeymen - 1:4

Craft: Plumber **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE FOR THOSE APPRENTICES ENTERING PROGRAM AFTER 5-1-14:

INTERVAL	PERIOD AND RATES									
6 Months	30%	35%	45%	50%	55%	60%	65%	70%	75%	80%
Benefits	26.64	27.85	30.26	31.46	32.65	33.86	35.07	36.28	37.48	38.68

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 - CAPE MAY

Craft: Roofer **PREVAILING WAGE RATE**

	05/02/18
Foreman (5 workers or less)	W39.15 B31.27 T70.42
Foreman (6 workers or more)	W39.65 B31.27 T70.92
Journeyman	W37.15 B31.27 T68.42

Craft: Roofer **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	52%	55%	60%	75%						
Benefits	22.29	24.54	31.27	31.27						

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 - CAPE MAY

Craft: Roofer - Shingle, Slate & Tile **PREVAILING WAGE RATE**

	05/02/18
Foreman (3 workers or less)	W27.75 B20.37 T48.12
Foreman (4 workers or more)	W28.50 B20.37 T48.87
Helper	W13.75 B20.37 T34.12
Journeyman (shingle work)	W27.50 B20.37 T47.87

Craft: Roofer - Shingle, Slate & Tile **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
Yearly	60%	70%	80%							

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 - CAPE MAY

Craft: Sheet Metal Sign Installation **PREVAILING WAGE RATE**

	07/28/17
Foreman	W27.03 B22.76 T49.79
Journeyman	W25.03 B22.76 T47.79

Craft: Sheet Metal Sign Installation **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1000 Hours	40%	45%	50%	55%	60%	65%	70%	75%	80%	90%

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 - CAPE MAY

Craft: Sheet Metal Worker **PREVAILING WAGE RATE**

	06/01/17
Foreman	W48.71 B40.04 T88.75
Journeyman	W45.71 B40.04 T85.75

Craft: Sheet Metal Worker **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
6 months	40%	45%	50%	55%	60%	65%	70%	75%		
Benefits	12.22	13.68	15.14	16.59	23.10	24.98	26.86	28.73		

Ratio of Apprentices to Journeymen- 1:3, except for the following types of work where the ratio shall be 1:1 (architectural metal work, testing and balancing, lockers, shelving and toilet partitions).*
* For work performed in a fabrication shop, the ratio will be applied on a "company-wide" basis (i.e. the total number of apprentices and journeymen employed by the company).

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Craft: Sheet Metal Worker **COMMENTS/NOTES**

APPRENTICE RATE SCHEDULE AS OF 6-1-17:

INTERVAL	PERIOD AND RATES							
6 Months	40%	45%	50%	55%	60%	65%	70%	75%
Benefits	13.04	14.57	16.10	17.63	19.15	26.32	28.28	30.24

JOB SITE FOREMAN REQUIREMENTS:
- When there are 2 to 9 Sheet Metal Workers on a jobsite, 1 must be designated a Foreman.
- When there are 10 to 16 Sheet Metal Workers on a job site, 2 must be designated Foremen.
- When there are 17 to 23 Sheet Metal Workers on a job site, 3 must be designated Foremen.
- For every 7 addtional Sheet Metal Workers on a job site, there shall be 1 additional Foreman.

SHOP FOREMAN REQUIREMNTS (For custom fabrication):
- When there are 1 to 10 Sheet Metal Workers in the shop, 1 must be designated a Foreman.
- For every 10 additional Sheet Metal Workers in the shop, 1 must be designated a 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.
There must be a day shift worked in order to have a 2nd and/or 3rd Shift.
- Shop work does not satisfy shift requirements.
- 2nd Shift (4:30 PM-12:30 AM) shall be paid an additional 15% of the regular rate per hour inclusive of benefits, and

receive 8 hours pay for 7.5 hours of work.
- 3rd Shift (12:30 AM-8:00 AM) shall be paid an additional 25% of the regular rate per hour inclusive of benefits, and receive 8 hours pay for 7 hours of work.

OVERTIME:
Hours in excess of 8 per day, or before or after 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. All hours on Sundays and holidays shall be paid at double the regular rate.

RECOGNIZED HOLIDAYS: New Year's Day, Presidents' Day, Good Friday, Memorial Day, July 4th, Labor Day, Presidential Election Day, Veterans' Day, Thanksgiving Day, 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 - CAPE MAY

Craft: Sprinkler Fitter **PREVAILING WAGE RATE**

	04/01/18
Foreman	W53.00 B23.98 T76.98
General Foreman	W55.25 B23.98 T79.23
Journeyman	W50.25 B23.98 T74.23

Craft: Sprinkler Fitter **APPRENTICE RATE SCHEDULE**

INTERVAL	PERIOD AND RATES									
1000 Hours	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%
Benefits	7.90	7.90	14.87	14.87	14.87	14.87	14.87	14.87	14.87	14.87

Ratio of Apprentices to Journeymen - 1:1

Craft: Sprinkler Fitter **COMMENTS/NOTES**

FOREMAN REQUIREMENTS:
- There must be a Foreman on all projects. If there is only 1 Sprinkler Fitter on the project, he/she shall be designated a Foreman.
- On any job with 22 or more Sprinkler Fitters 1 shall be designated a General Foreman.

The regular workday consists of 8 hours, between 6:00 AM and 6:00 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for a minimum of 5 consecutive workdays.
- 2nd and/or 3rd 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 that are not shift work, 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 Friday.

RECOGNIZED HOLIDAYS: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, 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 - CAPE MAY

Craft: Tile Worker **PREVAILING WAGE RATE**

	06/11/18
Finisher	W40.22 B27.07 T67.29
Setter	W46.56 B32.69 T79.25

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 - CAPE MAY

Craft: Truck Driver **PREVAILING WAGE RATE**

	05/01/18
Bucket, Seeding/Fertilizing/ Mulching trucks	W37.53 B20.40 T57.93
Concrete mobile unit; Tack Spreader, Transit Mix trucks	W37.53 B20.40 T57.93
Dump, Tank, Pick-up, Vacuum or Vac-All trucks	W37.53 B20.40 T57.93
Helper on Straight 3-axle truck, Mechanic's helper	W37.33 B20.40 T57.73
Large, off-road dump or water truck	W37.88 B20.40 T58.28
Mechanic	W38.03 B20.40 T58.43
Shop Steward	W37.98 B20.40 T58.38
Straight 3-axle truck	W37.53 B20.40 T57.93
Tow Truck	W37.68 B20.40 T58.08
Tractor Trailer; Fuel, Winch, Asphalt Oil Distributor trucks	W37.88 B20.40 T58.28

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 DIFFERENTIAL:
- Second shift shall receive an additional $1.00 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.
- Employees may work four 10-hour days 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. When all trades agree, the day after Thanksgiving may be substituted for Veterans' Day. Sunday holidays will be observed the following Monday.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

County - CAPE MAY

Craft: Truck Driver-Material Delivery Driver **PREVAILING WAGE RATE**

	05/01/18
Driver	W37.53 B20.40 T57.93

Craft: Truck Driver-Material Delivery Driver **COMMENTS/NOTES**

HAZARDOUS WASTE WORK:
- All designated hazardous waste sites: + $1.00 per hour.

SHIFT DIFFERENTIAL:
- Second shift shall receive an additional $1.00 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.
- Employees may work four 10-hour days 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. When all trades agree, the day after Thanksgiving may be substituted for Veterans' Day. Sunday holidays will be observed the following Monday.

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 : 03/31/2020**

{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 4:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for 5 consecutive workdays.
- When 2 shifts are worked, the second shift shall receive an additional 10% of the regular rate inclusive of benefits, per hour.
- When 3 shifts are worked, the second shift shall receive 8 hours pay for 7.5 hours of work, plus an additional 10% of the regular rate inclusive of benefits, per hour. The third shift shall receive 8 hours pay for 7 hours of work, plus an additional 15% of the regular rate inclusive of benefits, per hour.
- When such hours are mandated by the project owner, a shift that starts between 8:00 PM and midnight and ends by 6:00 AM Saturday, or that starts after 8:00 PM on Sunday, provided there are consecutive hours of work within the shift, shall receive an additional 15% of the regular rate, inclusive of benefits.
- On Highway, Road, Street, and Sewer projects irregular shifts starting between 5:00 PM and 12:00 AM may be worked Monday through Friday, and shall receive an additional 15% of the regular rate, inclusive of benefits. When working with other trades that receive a higher irregular shift rate, the Operating Engineer shall also receive the higher irregular shift 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 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.
- 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 Veteran's Day.

On hazardous waste removal work or asbestos removal work, on a state or federally designated hazardous waste site, where the operating engineer is in direct contact with hazardous material and when personal protective equipment is required for respiratory, skin, and eye protection, the operating engineer shall receive an additional 20% of the hourly wage, per hour.

PERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

	01/01/2018		07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
48.98	31.70	80.68	82.03	83.03	85.38

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

Iydro-Blaster

OPERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
48.98	31.70	80.68	82.03	83.03	85.38

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)

'ERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
47.07	31.70	78.77	80.12	81.12	83.47

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 : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
47.07	31.70	78.77	80.12	81.12	83.47

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)

PERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
47.07	31.70	78.77	80.12	81.12	83.47

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 : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
47.07	31.70	78.77	80.12	81.12	83.47

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
43.73	31.70	75.43	76.78	77.78	80.13

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
41.15	31.70	72.85	74.20	75.20	77.55

CLASSIFICATIONS:

Field Engineer - Rodman or Chainman

PERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
51.31	31.70	83.01	84.36	85.36	87.71

CLASSIFICATIONS:

Lead Engineer, Foreman Engineer, Safety Engineer (minimum)

OPERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
50.57	31.70	82.27	83.62	84.62	86.97

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

PERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

	01/01/2018		07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
50.57	31.70	82.27	83.62	84.62	86.97

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 : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
45.44	31.70	77.14	78.49	79.49	81.84

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

PERATING ENGINEERS **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
45.44	31.70	77.14	78.49	79.49	81.84

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)

ffective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
52.39	31.70	84.09	85.44	86.44	88.79

CLASSIFICATIONS:

Helicoptor Pilot/Engineer

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
57.07	31.70	88.77	90.12	91.12	93.47

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
56.07	31.70	87.77	89.12	90.12	92.47

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 : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
52.57	31.70	84.27	85.62	86.62	88.97

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types) , under 100 tons with a boom (including jib and/or leads) 140 ft. and over

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
55.07	31.70	86.77	88.12	89.12	91.47

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
51.57	31.70	83.27	84.62	85.62	87.97

CLASSIFICATIONS:

Cranes, Derricks, Pile Driver (all types), under 100 tons with a boom (including jib and/or leads) from 100 ft. to 139 ft.

TRUCTURAL STEEL ERECTION **Rates Expiration Date : 03/31/2020**

{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 4:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for 5 consecutive workdays.
- When 2 shifts are worked, the second shift shall receive an additional 10% of the regular rate inclusive of benefits, per hour.
- When 3 shifts are worked, the second shift shall receive 8 hours pay for 7.5 hours of work, plus an additional 10% of the regular rate inclusive of benefits, per hour. The third shift shall receive 8 hours pay for 7 hours of work, plus an additional 15% of the regular rate inclusive of benefits, per hour.
- When such hours are mandated by the project owner, a shift that starts between 8:00 PM and midnight and ends by 6:00 AM Saturday, or that starts after 8:00 PM on Sunday, provided there are consecutive hours of work within the shift, shall receive an additional 15% of the regular rate, inclusive of benefits.
- On Highway, Road, Street, and Sewer projects irregular shifts starting between 5:00 PM and 12:00 AM may be worked Monday through Friday, and shall receive an additional 15% of the regular rate, inclusive of benefits. When working with other trades that receive a higher irregular shift rate, the Operating Engineer shall also receive the higher irregular shift 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 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.
- 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.

:COGNIZED 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 Veteran's Day.

On hazardous waste removal work or asbestos removal work, on a state or federally designated hazardous waste site, where the operating engineer is in direct contact with hazardous material and when personal protective equipment is required for respiratory, skin, and eye protection, the operating engineer shall receive an additional 20% of the hourly wage, per hour.

Effective Dates:

	01/01/2018		07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
54.20	31.70	85.90	87.25	88.25	90.60

CLASSIFICATIONS:

Helicopter Co-Pilot & Communications Engineer

STRUCTURAL STEEL ERECTION **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
50.14	31.70	81.84	83.19	84.19	86.54

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

TRUCTURAL STEEL ERECTION **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
47.48	31.70	79.18	80.53	81.53	83.88

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 : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
45.95	31.70	77.65	79.00	80.00	82.35

CLASSIFICATIONS:

Compressor (Single)

Generators

Welding Machines, Gas, Diesel, Or Electric Converters of any type-single

Welding System, Multiple (Rectifier Transformer Type)

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
44.19	31.70	75.89	77.24	78.24	80.59

CLASSIFICATIONS:

Assistant Engineer/Oiler

Drillers Helper

Field Engineer - Transit/Instrument Man

Maintenance Apprentice (Deckhand)

Maintenance Apprentice (Oiler)

Off Road Back Dump

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
51.76	31.70	83.46	84.81	85.81	88.16

CLASSIFICATIONS:

Lead Engineer, Foreman Engineer, Safety Engineer (Minimum)

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
41.15	31.70	72.85	74.20	75.20	77.55

CLASSIFICATIONS:

Field Engineer - Rodman or Chainman

TRUCTURAL STEEL ERECTION **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
50.90	31.70	82.60	83.95	84.95	87.30

CLASSIFICATIONS:

Field Engineer-Chief of Party

Vacuum Truck

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
59.09	31.70	90.79	92.14	93.14	95.49

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
57.43	31.70	89.13	90.48	91.48	93.83

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
54.59	31.70	86.29	87.64	88.64	90.99

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
52.93	31.70	84.63	85.98	86.98	89.33

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.

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PREVAILING WAGE RATE DETERMINATION

STRUCTURAL STEEL ERECTION **Rates Expiration Date : 03/31/2020**

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
54.59	31.70	86.29	87.64	88.64	90.99

CLASSIFICATIONS:

Helicopter Pilot & Engineer

EST BORING PRELIMINARY TO CONSTRUCTION-SOUTH/WEST **Rates Expiration Date : 03/31/2020**

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 4:30 PM.

SHIFT DIFFERENTIALS:
- Shift work must run for 5 consecutive workdays.
- When 2 shifts are worked, the second shift shall receive an additional 10% of the regular rate inclusive of benefits, per hour.
- When 3 shifts are worked, the second shift shall receive 8 hours pay for 7.5 hours of work, plus an additional 10% of the regular rate inclusive of benefits, per hour. The third shift shall receive 8 hours pay for 7 hours of work, plus an additional 15% of the regular rate inclusive of benefits, per hour.
- When such hours are mandated by the project owner, a shift that starts between 8:00 PM and midnight and ends by 6:00 AM Saturday, or that starts after 8:00 PM on Sunday, provided there are consecutive hours of work within the shift, shall receive an additional 15% of the regular rate, inclusive of benefits.
- On Highway, Road, Street, and Sewer projects irregular shifts starting between 5:00 PM and 12:00 AM may be worked Monday through Friday, and shall receive an additional 15% of the regular rate, inclusive of benefits. When working with other trades that receive a higher irregular shift rate, the Operating Engineer shall also receive the higher irregular shift 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 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.
- 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.

:COGNIZED 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 Veteran's Day.

On hazardous waste removal work or asbestos removal work, on a state or federally designated hazardous waste site, where the operating engineer is in direct contact with hazardous material and when personal protective equipment is required for respiratory, skin, and eye protection, the operating engineer shall receive an additional 20% of the hourly wage, per hour.

Effective Dates:

	01/01/2018		07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
50.57	31.70	82.27	83.62	84.62	86.97

CLASSIFICATIONS:

Driller

Effective Dates:

	01/01/2018		07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
43.73	31.70	75.43	76.78	77.78	80.13

CLASSIFICATIONS:

Driller's Helper

FREE AIR TUNNEL JOBS **Rates Expiration Date : 02/28/2021**

{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: + $3.00/hr
-other Hazardous Waste site: + $1.00/hr

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
42.00	29.73	71.73	73.03	75.78	78.28

CLASSIFICATIONS:

Walking Boss & Superintendent

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
41.70	29.73	71.43	72.73	75.48	77.98

CLASSIFICATIONS:

Heading Foreman, Shaft Foreman, Rod Foreman, Electrician Foreman, Rigging Foreman

EE AIR TUNNEL JOBS **Rates Expiration Date : 02/28/2021**

ffective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
41.20	29.73	70.93	72.23	74.98	77.48

CLASSIFICATIONS:

Iron Foreman, Caulking Foreman, Form Foreman, Cement Finishing Foreman, Concrete Foreman, Track Foreman, Cleanup Foreman, Grout Foreman

Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
43.70	29.73	73.43	74.73	77.48	79.98

CLASSIFICATIONS:

Blaster

Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.65	29.73	70.38	71.68	74.43	76.93

LASSIFICATIONS:

Top Labor Foreman

Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.30	29.73	70.03	71.33	74.08	76.58

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:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.15	29.73	69.88	71.18	73.93	76.43

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

FREE AIR TUNNEL JOBS **Rates Expiration Date : 02/28/2021**

Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.75	29.73	69.48	70.78	73.53	76.03

CLASSIFICATIONS:

All Others (including Powder Watchman, Change House Attendant, Top Laborer)

RILL FOR GROUND WATER SUPPLY **Rates Expiration Date : 03/31/2020**

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:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
49.32	31.70	81.02	82.37	83.37	85.72

CLASSIFICATIONS:

Driller

Effective Dates:

01/01/2018			07/01/2018	01/01/2019	07/01/2019
Rate	Fringe	Total	Total	Total	Total
42.48	31.70	74.18	75.53	76.53	78.88

CLASSIFICATIONS:

Driller's Helper

OPERATING ENGINEERS MARINE-DREDGING **Rates Expiration Date : 09/30/2018**

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:

10/01/2017

Rate	Fringe	Total
38.18	14.33	52.51

CLASSIFICATIONS:

Lead Dredgerman, Operator, Leverman

Licensed Tug Operator (over 1000 HP)

Effective Dates:

10/01/2017

Rate	Fringe	Total
33.03	13.92	46.95

CLASSIFICATIONS:

Derrick Operator, Spider/Spill Barge Operator

Engineer, Electrician, Chief Welder, Chief Mate

Fill Placer, Operator II

Licensed Boat Operator

Maintenance Engineer

Effective Dates:

10/01/2017

Rate	Fringe	Total
31.09	13.77	44.86

CLASSIFICATIONS:

Certified Welder

PERATING ENGINEERS MARINE-DREDGING **Rates Expiration Date : 09/30/2018**

Effective Dates:

	10/01/2017	
Rate	Fringe	Total
30.24	13.40	43.64

CLASSIFICATIONS:

Mate, Drag Barge Operator, Steward, Assistant Fill Placer

Welder

Effective Dates:

	10/01/2017	
Rate	Fringe	Total
29.26	13.32	42.58

CLASSIFICATIONS:

Boat Operator

Effective Dates:

	10/01/2017	
Rate	Fringe	Total
24.30	12.62	36.92

CLASSIFICATIONS:

Shoreman, Deckhand, Rodman, Scowman

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PREVAILING WAGE RATE DETERMINATION

MICROSURFACING/SLURRY SEAL **Rates Expiration Date : 02/28/2018**

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

ICROSURFACING/SLURRY SEAL **Rates Expiration Date : 02/28/2018**

Effective Dates:

	03/01/2017	
Rate	Fringe	Total
30.30	21.27	51.57

CLASSIFICATIONS:

Cleaner, Taper

ASPHALT LABORERS - SOUTH **Rates Expiration Date : 02/28/2021**

"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: + $3.00/hr
-other Hazardous Waste site: + $1.00/hr

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
41.50	29.73	71.23	72.53	75.28	77.78

CLASSIFICATIONS:

Paving Foreman

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.05	29.73	69.78	71.08	73.83	76.33

CLASSIFICATIONS:

Head Raker

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.90	29.73	69.63	70.93	73.68	76.18

CLASSIFICATIONS:

Raker, Screedman, Luteman

SPHALT LABORERS - SOUTH **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.65	29.73	69.38	70.68	73.43	75.93

CLASSIFICATIONS:

Tampers, Smoothers, Kettlemen,
Painters, Shovelers, Roller Boys

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.75	29.73	69.48	70.78	73.53	76.03

CLASSIFICATIONS:

Milling Controller

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.95	29.73	69.68	70.98	73.73	76.23

CLASSIFICATIONS:

Traffic Control Coordinator

TEST BORING PRELIMINARY TO CONSTRUCTION-NORTH **Rates Expiration Date : 10/16/2018**

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 $1.00 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 10% 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:

10/17/2017

Rate	Fringe	Total
31.62	25.55	57.17

CLASSIFICATIONS:

Helper (4th year helper)

Effective Dates:

10/17/2017

Rate	Fringe	Total
39.69	25.55	65.24

CLASSIFICATIONS:

Driller

Effective Dates:

10/17/2017

Rate	Fringe	Total
45.73	25.55	71.28

CLASSIFICATIONS:

Foreman

HEAVY & GENERAL LABORERS - NORTH **Rates Expiration Date : 02/28/2021**

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 all be paid at double the hourly rate.

Hazardous Waste Work:
-where Level A, B, or C protection is required: + $3.00/hr
-other Hazardous Waste site: + $1.00/hr
Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.25	29.73	68.98	70.28	73.03	75.53

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:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.95	29.73	69.68	70.98	73.73	76.23

CLASSIFICATIONS:

"C" Rate:
pipe layer; laser man; conduit or duct line layer; operator of jack hammer, chipping hammer, pavement breaker, concrete cutter, asphalt utter, sheet hammer, or walk-behind saw cutter; sandblaster; acetylene cutting or burning; wagon drill, directional drill, or hydraulic drill operator; drill master; core driller; traffic control coordinator; asphalt raker or lute man

HEAVY & GENERAL LABORERS - NORTH **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.20	29.73	69.93	71.23	73.98	76.48

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:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
43.75	29.73	73.48	74.78	77.53	80.03

CLASSIFICATIONS:

"A" Rate:
blaster

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
41.50	29.73	71.23	72.53	75.28	77.78

CLASSIFICATIONS:

"FOREMAN" Rate:
labor foreman, asphalt foreman, drill foreman, pipe foreman, grade foreman, finisher foreman, concrete foreman

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
42.50	29.73	72.23	73.53	76.28	78.78

CLASSIFICATIONS:

"GENERAL FOREMAN" Rate

HEAVY & GENERAL LABORERS - SOUTH **Rates Expiration Date : 02/28/2021**

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.

azardous Waste Work:
-where Level A, B, or C protection is required: + $3.00/hr
-other Hazardous Waste site: + $1.00/hr
Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.25	29.73	68.98	70.28	73.03	75.53

CLASSIFICATIONS:

basic, landscape, or railroad track laborer; utility meter installer; flagman; salamander tender; pitman; dumpman; rakers or tampers on cold patch work; wrappers or coaters of pipe; waterproofers; tree cutter, timberman
Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.25	29.73	68.98	70.28	73.03	75.53

CLASSIFICATIONS:

wagon drill or drill master helper; powder carrier; magazine tender; signal man

HEAVY & GENERAL LABORERS - SOUTH **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.95	29.73	69.68	70.98	73.73	76.23

CLASSIFICATIONS:

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

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.95	29.73	69.68	70.98	73.73	76.23

CLASSIFICATIONS:

wagon or directional drill operator; drill master

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
43.75	29.73	73.48	74.78	77.53	80.03

CLASSIFICATIONS:

blaster

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
41.50	29.73	71.23	72.53	75.28	77.78

CLASSIFICATIONS:

labor foreman, drill foreman, pipe foreman, grade foreman, finisher foreman, concrete foreman

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
42.50	29.73	72.23	73.53	76.28	78.78

CLASSIFICATIONS:

general foreman

HEAVY & GENERAL LABORERS - SOUTH **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.20	29.73	69.93	71.23	73.98	76.48

CLASSIFICATIONS:

concrete finisher; setter of brick or stone pavers; stone cutter; form setter; manhole, catch basin, or inlet builder; rammer; gunite nozzle man

PIPELINE - MAINLINE TRANSMISSION **Rates Expiration Date : 06/03/2019**

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: $42.50; Pipeline Journeyman Welder: $102.50; and Pipeline Helper: $42.50. 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:

06/08/2018

Rate	Fringe	Total
54.61	29.59	84.20

CLASSIFICATIONS:

Pipeline Journeyman Welder

PELINE - MAINLINE TRANSMISSION **Rates Expiration Date : 06/03/2019**

Effective Dates:

06/08/2018

Rate	Fringe	Total
54.61	29.59	84.20

CLASSIFICATIONS:

Pipeline Journeyman

Effective Dates:

06/08/2018

Rate	Fringe	Total
33.55	20.42	53.97

CLASSIFICATIONS:

Pipeline Helper

PIPELINE - GAS DISTRIBUTION **Rates Expiration Date : 10/31/2020**

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:

11/05/2017			11/01/2018	11/01/2019
Rate	Fringe	Total	Total	Total
58.83	22.55	81.38	82.96	84.63

CLASSIFICATIONS:

Pipeline Journeyman Welder

Effective Dates:

11/05/2017			11/01/2018	11/01/2019
Rate	Fringe	Total	Total	Total
58.83	22.55	81.38	82.96	84.63

CLASSIFICATIONS:

Pipeline Journeyman

Effective Dates:

11/05/2017			11/01/2018	11/01/2019
Rate	Fringe	Total	Total	Total
37.68	16.74	54.42	56.00	57.67

CLASSIFICATIONS:

Pipeline Helper

SPHALT LABORERS- NORTH **Rates Expiration Date : 02/28/2021**

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: + $3.00/hr
-other Hazardous Waste site: + $1.00/hr

ffective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
41.50	29.73	71.23	72.53	75.28	77.78

CLASSIFICATIONS:

Asphalt Foreman

Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
40.20	29.73	69.93	71.23	73.98	76.48

CLASSIFICATIONS:

Asphalt Screedman

Effective Dates:

	03/01/2018		09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.95	29.73	69.68	70.98	73.73	76.23

CLASSIFICATIONS:

ısphalt Raker or Lute Man

TERRITORY

ENTIRE STATE

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

ASPHALT LABORERS- NORTH **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
39.25	29.73	68.98	70.28	73.03	75.53

CLASSIFICATIONS:

Asphalt Laborer

LECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date : 11/30/2021**

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 7:00 AM and 6:30 PM, Monday through Thursday.

:COGNIZED 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:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
53.70	35.97	89.67	92.06	94.45	96.84

CLASSIFICATIONS:

Chief Lineman

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
50.66	33.94	84.60	86.85	89.11	91.36

CLASSIFICATIONS:

Journeyman Lineman

ELECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date : 11/30/2021**

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
50.66	33.94	84.60	86.85	89.11	91.36

CLASSIFICATIONS:

Special License Operator

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
50.16	33.60	83.76	85.98	88.22	90.44

CLASSIFICATIONS:

Transit Man

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
48.64	32.58	81.22	83.38	85.53	87.70

CLASSIFICATIONS:

Line Equipment Operator

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
42.56	28.51	71.07	72.96	74.84	76.73

CLASSIFICATIONS:

Dynamite Man

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
63.33	42.43	105.76	108.56	111.38	114.19

CLASSIFICATIONS:

General Foreman

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
58.26	39.03	97.29	99.88	102.47	105.05

CLASSIFICATIONS:

Assistant General Foreman

LECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date : 11/30/2021**

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
56.74	38.01	94.75	97.27	99.79	102.32

CLASSIFICATIONS:

Line Foreman

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
41.04	27.49	68.53	70.35	72.17	73.99

CLASSIFICATIONS:

Street Light Mechanical Leader

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
39.01	26.13	65.14	66.88	68.62	70.34

CLASSIFICATIONS:

Groundman Winch Operator

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
39.01	26.13	65.14	66.88	68.62	70.34

CLASSIFICATIONS:

Groundman Truck Operator

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
38.51	25.80	64.31	66.01	67.71	69.43

CLASSIFICATIONS:

Street Light Mechanic

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
38.51	25.80	64.31	66.01	67.71	69.43

CLASSIFICATIONS:

Line Equipment Mechanic

ELECTRICIAN- UTILITY WORK (NORTH) **Rates Expiration Date : 11/30/2021**

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
32.93	22.06	54.99	56.46	57.91	59.38

CLASSIFICATIONS:

Groundman 2nd Year

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
30.40	20.36	50.76	52.12	53.47	54.80

CLASSIFICATIONS:

Groundman 1st Year

Effective Dates:

12/05/2017			12/02/2018	12/01/2019	11/29/2020
Rate	Fringe	Total	Total	Total	Total
50.16	33.60	83.76	85.98	88.22	90.44

CLASSIFICATIONS:

Line Equipment Foreman

LECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date : 12/04/2021**

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 all 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:

	12/03/2017	
Rate	Fringe	Total
60.25	46.05	106.30

CLASSIFICATIONS:

General Foreman

ELECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date : 12/04/2021**

Effective Dates:

12/03/2017

Rate	Fringe	Total
53.66	42.21	95.87

CLASSIFICATIONS:

Foreman

Effective Dates:

12/03/2017

Rate	Fringe	Total
50.84	40.58	91.42

CLASSIFICATIONS:

Small Job Foreman

Effective Dates:

12/03/2017

Rate	Fringe	Total
47.07	38.39	85.46

CLASSIFICATIONS:

Heavy Equipment Operator

Effective Dates:

12/03/2017

Rate	Fringe	Total
47.07	38.39	85.46

CLASSIFICATIONS:

Cable Splicer

Effective Dates:

12/03/2017

Rate	Fringe	Total
47.07	38.39	85.46

CLASSIFICATIONS:

Journeyman Lineman

Effective Dates:

12/03/2017

Rate	Fringe	Total
47.07	38.39	85.46

CLASSIFICATIONS:

Journeyman Welder

LECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date : 12/04/2021**

Effective Dates:

	12/03/2017	
Rate	Fringe	Total
47.07	38.39	85.46

CLASSIFICATIONS:

Journeyman Painter

Effective Dates:

	12/03/2017	
Rate	Fringe	Total
37.66	32.92	70.58

CLASSIFICATIONS:

Light Equipment Operator

Effective Dates:

	12/03/2017	
Rate	Fringe	Total
32.95	30.18	63.13

CLASSIFICATIONS:

Groundman Truck Driver

Effective Dates:

	12/03/2017	
Rate	Fringe	Total
30.60	28.82	59.42

CLASSIFICATIONS:

Groundman 3rd Year

Effective Dates:

	12/03/2017	
Rate	Fringe	Total
28.24	27.44	55.68

CLASSIFICATIONS:

Groundman 2nd Year

Effective Dates:

	12/03/2017	
Rate	Fringe	Total
25.89	26.08	51.97

CLASSIFICATIONS:

Groundman 1st Year

TERRITORY

ENTIRE STATE

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

PREVAILING WAGE RATE DETERMINATION

ELECTRICIAN- UTILITY WORK (SOUTH) **Rates Expiration Date : 12/04/2021**

Effective Dates:

12/03/2017

Rate	Fringe	Total
20.71	23.07	43.78

CLASSIFICATIONS:

Flagman

EAVY & GENERAL LABORERS- NEW TRANS HUDSON TUNNELS **Rates Expiration Date : 02/28/2021**

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 ection Day, Veterans' Day, Thanksgiving Day, Christmas Day. Sunday holidays observed the following Monday. Veterans Day may be ɔstituted 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: + $3.00/hr
-other Hazardous Waste site: + $1.00/hr

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
63.00	29.73	92.73	94.41	97.91	101.16

CLASSIFICATIONS:

Walking Boss & Superintendent

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
62.55	29.73	92.28	93.96	97.46	100.71

CLASSIFICATIONS:

Heading Foreman, Shaft Foreman, Rod Foreman, Electrical Foreman, Rigging Foreman

HEAVY & GENERAL LABORERS- NEW TRANS HUDSON TUNNELS **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
61.80	29.73	91.53	93.21	96.71	99.96

CLASSIFICATIONS:

Iron Foreman, Caulking Foreman, Form Foreman, Cement Finishing Foreman, Concrete Foreman, Track Foreman, Clean-up Foreman, Grout Foreman

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
65.55	29.73	95.28	96.96	100.46	103.71

CLASSIFICATIONS:

Blaster

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
60.98	29.73	90.71	92.38	95.88	99.13

CLASSIFICATIONS:

Top Labor Foreman

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
60.45	29.73	90.18	91.86	95.36	98.61

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:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
60.23	29.73	89.96	91.63	95.13	98.38

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)

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PREVAILING WAGE RATE DETERMINATION

EAVY & GENERAL LABORERS- NEW TRANS HUDSON TUNNELS **Rates Expiration Date : 02/28/2021**

Effective Dates:

03/01/2018			09/01/2018	03/01/2019	03/01/2020
Rate	Fringe	Total	Total	Total	Total
59.63	29.73	89.36	91.03	94.53	97.78

CLASSIFICATIONS:

All others (including Powder Watchman, Change House Attendant, Top Laborer, Job Steward)

Specifications

For

82nd Street Recreation Facility Tennis Court Building

Borough of Stone Harbor, Cape May County, New Jersey

June 2018

Prepared by:

MOORE

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PROFESSIONAL ENGINEER

Jeffrey A. Moore, P.E., License # 24GE04051000

MCE Project # 18050

SECTION 220000 - GENERAL PROVISIONS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 DEFINITIONS

A. "Provide": to supply, install, and make complete, safe, and operable, the particular work referred to unless specifically indicated otherwise.

B. "Install": to erect, mount, and make complete with all related accessories.

C. "Furnish" or "supply": to purchase, procure, acquire, and deliver complete with related accessories.

D. "Work": labor, materials, equipment, services, and all related accessories necessary for the proper and complete installation of complete systems.

E. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and all related accessories.

F. "Wiring": raceway, fittings, wire, boxes and all related accessories.

G. "Indicated," "shown," or "noted": as indicated, shown, or noted on drawings or specifications.

H. "Similar" or "equal": of base bid manufacture, equal in quality materials, weight, size, performance, design, and efficiency of specified product, conforming with "Base Bid Manufacturers."

I. "Reviewed" "satisfactory," "accepted," or "directed": as reviewed, satisfactory, accepted, or directed by Architect and/or Engineer.

J. "Motor Controllers": manual or magnetic starters with or without switches, individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

K. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, flow, operation of equipment.

L. 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, crawl spaces, and tunnels.

M. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

N. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

O. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

P. 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.

Q. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

R. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.3 WORK INCLUDED

A. The work covered by this section includes the construction described in the Contract Documents including all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction, and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The work includes, but is not limited to the following:

1. Domestic Water Systems.
2. Soil, Waste, Vent and Storm Water Systems.
3. Natural Gas System
4. Piping, Valves and Fittings
5. Water Meters and Backflow Prevention Devices
6. Insulation.
7. Domestic Water Heaters.
8. Pumps.
9. Pressure Tanks.
10. Identification System.
11. Excavation and Backfill.
12. Cutting, Patching and Equipment Painting.
13. Hangers, Supports and Guides.
14. Electric Motors.
15. Electric Motor Controllers.

16. Internal Wiring of Factory-Assembled Prewired Equipment.
17. Alarm Wiring, except for Fire Alarm.
18. Rigging of Equipment.
19. Access Doors and Frames.
20. Fire Stopping for Pipe Penetration.
21. Pipe Penetration and Drains Counterflashing.
22. Concrete Pads for Equipment.
23. Alarm Initiating Devices.
24. Wiring between Water Meter Totalizer and Remote Reading Device.
25. Radon Venting Systems.

B. Related Work not Included in this Division but Specified Elsewhere

1. Fire alarm wiring.
2. Finish painting, except for prefinished equipment or as otherwise specified.
3. Concrete work, except equipment inertia and floating bases.
4. Base flashing for piping and drains.
5. Toilet accessories.
6. Waterproofing.
7. Power wiring for motors and motor controllers.
8. Installation of access doors and frames.

1.4 COORDINATION OF WORK

A. The plumbing drawings show the general arrangement of piping and appurtenances. Follow these drawings as closely as the actual construction will permit. Conform the plumbing work to the requirements shown on the drawings. Provide offsets, fittings, and accessories, which may be required but not shown on the drawings. Investigate the site, structural and finish ground conditions affecting the work, and arrange the work accordingly. Provide such work and accessories as may be required to meet such conditions.

B. Certain materials shall be provided by other trades. Examine the Contract Documents to ascertain these requirements.

C. Carefully check space requirements with other trades to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings.

D. Transmit to other trades all information required for work to be provided under their sections, in ample time for installation.

E. Wherever work interconnects with work specified of other trades, coordinate to insure that all necessary information is presented so that all the necessary connections and equipment may be properly installed. Identify all items (valves, piping, equipment, etc.) and provide access doors and panels.

F. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacturer.

G. Furnish and set all sleeves for passage of pipes and conduits through structural masonry and concrete walls and floors and elsewhere as shall be required for the proper protection of each pipe passing through building surfaces.

H. Provide required supports and hangers for piping and equipment, designed so as not to exceed allowable loadings of structures.

I. Examine and compare the contract drawings and specifications with the drawings and specifications of other disciplines, and report any discrepancies between themand obtain from him written instructions for changes necessary in the work of this Section. Install and coordinate the work of this section in cooperation with installing interrelated work. Before installation, take proper provisions to avoid interferences. All changes required in the work of the contractor, caused by his neglect to do so, to be made by him at his own expense.

J. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale similar to that of the design drawings, prepared on tracing medium of the same size as contract drawings. With these layouts, coordinate the work with the work of the contractor. Such detailed work is to be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion, however, include a set of such drawings with each set of as-built drawings. When directed by the Engineer, submit drawings for review, clearly showing the work of this section and its relation to the work of other disciplines before commencing shop fabrication or erection in the field.

K. Before commencing work, examine all adjoining work on which this work is in any way dependent for perfect workmanship and report any conditions, which prevent performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

L. Provide required anchor bolts, sleeves, inserts and supports. Direct location of anchor bolts, sleeves, inserts and supports to insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports to be paid for by the contractor.

M. Slots, chases, openings and recesses through floors, walls, ceilings, and roofs shall be provided by the various trades in their respective materials. Properly locate such openings and be responsible for any cutting and patching caused by the neglect to do so.

N. Adjust location of pipes, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe prior to fabrication.

1. Right-of-Way: Lines, which pitch has the right-of-way over those that do not pitch, i.e., plumbing drains. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
2. Make offsets, transitions and changes in direction in pipes as required to maintain proper head room and pitch on sloping lines whether or not indicated on the drawings. Furnish and install all traps, air vents, drains, etc., as required to affect these offsets, transitions and changes in direction.

O. Install all plumbing work to permit the removal (without damage to other parts) of water heaters and all other equipment requiring periodic replacement or maintenance. Arrange pipes and equipment to permit access to valves, cocks, starters, motors, and control components, and to clear the openings of swinging doors and access panels.

P. Provide access panels in equipment as required for inspection and maintenance of internal parts, etc.

Q. The contractor shall coordinate his work with the work of other trades.

R. Coordinated Composite Drawings

1. The Contractor shall prepare full coordinated composite drawings for the mechanical, electrical and fire protection trades. The Contractor will overlay each trade's work (in separate colors) on a sepia set of sheetmetal drawings. All conflicts and potential conflicts shall be clearly identified on the sepia sheetmetal drawings. This shall include but not be limited to conflicts with lights, equipment, piping, ductwork and supports of other trades, as well as conflicts with architectural and structural walls, columns, ceilings and structural beams. Contractor shall have representatives of each trades, as well as conflicts with architectural and structural walls, columns, ceilings and structural beams. Contractor shall have representatives of each trade attend a weekly job site coordination meeting in the Contractor's field office. All trades shall resolve conflicts at these meetings and sign off each sepia sheetmetal drawing indicating acceptance and satisfactory resolution to all conflicts. All conflicts that cannot be resolved shall be brought to the attention of the Engineer for resolution.

1.5 USE OF SITE AND LOAD LIMITATIONS

A. The contractor shall review all available data on the location and types of pipelines and other underground utilities. The contractor shall not operate equipment over the facilities and shall take care not to damage them or otherwise impair their use. The contractor shall make investigation to verify the location of these facilities before proceeding with construction and/or operations in their vicinity.

1.6 CONTRACTOR'S RESPONSIBILITY FOR EVALUATION

A. The Engineer and Owner make no representations, regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground or other subsurface conditions which may be encountered during the Work. The contractor must make his own evaluation of existing conditions, which may affect methods or cost of performing the Work, based on his own examination of the facility or other information. Failure to examine the drawings or other information shall not relieve the contractor of his responsibility for satisfactory accomplishment of the Work.

B. The locations of existing services are believed to be as indicated on the plans. The contractor shall verify the location of these services prior to commencing any work and notify the Engineer of any discrepancies.

1.7 ACCESS TO FIRE PROTECTION EQUIPMENT

A. The contractor shall not interfere with access to hydrants, fire exits, fire hose stations, fire extinguishers and fire alarm pull stations. In no case shall the contractor's material or equipment be within twenty-five (25) ft of a hydrant or fire alarm pull station.

1.8 EQUIPMENT AND MATERIALS

A. If products and materials are specified or indicated on the drawings for a specific item or system, the contractor shall use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, in accordance with shop drawings.

B. All products and materials shall be new, clean, free of defects and free of damage and corrosion.

C. No permanent equipment shall be used to provide temporary services during construction.

D. Ship and store all products and materials in a manner which shall protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair.

E. Make certain that all materials selected directly, or by suppliers, conform to the requirements of the contract drawings and specification. Transmittal of such specifications and drawings, information to persons manufacturing and supplying materials to the project, and rigid adherence thereto, is the Contractor's responsibility. Acceptance of a manufacturer's name by the Engineer does not release the Contractor of the responsibility for providing materials, which comply in all respects with the requirements in the Contract Documents.

F. Applicable equipment and materials to be listed by Underwriters' Laboratories and Manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by local authorities having jurisdiction.

G. Fully lubricate all equipment when installed and prior to final acceptance.

H. Do not operate water systems until piping has been tested and cleaned.

I. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout all machinery set in concrete under the entire bearing surface. After grout has set, remove all wedges, shims and jack bolts and fill space with grout.

J. Locate valves, traps, access doors, etc., to be easily accessible, either in mechanical spaces or through access panels specified herein.

K. Follow manufacturers' instructions for installing, connecting, and adjusting all equipment. Provide one copy of such instructions to the Engineer before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special valves, piping, wiring and accessories.

1.9 QUALITY ASSURANCE

A. Codes, Standards and Fees

1. Codes and Standards:

a. Comply with all current governing codes, ordinances and regulations, UL and all other applicable codes.
b. Comply with the requirements of the State adopted Building Code, and other agencies or authorities having jurisdiction over any part of the Work and secure all necessary permits.
c. Where codes or standards are listed herein, the applicable portions apply.
d. Plans, specifications, codes and standards are all minimum requirements. Where requirements differ, apply the more stringent.
e. Should any change in plans or specifications be required to comply with governing regulations, the contractor is to notify the Engineer at the pre-bid meeting.
f. The codes and standards listed in the Specifications can be obtained from the organizations listed as follows:

1) OSHA Occupational Safety and Health Act
2) ANSI American National Standard Institute, Inc.
3) ASME American Society of Mechanical Engineers
4) ASTM American Society for Testing and Materials
5) AWWA American Water Works Association
6) UL Underwriters Laboratories, Inc.
7) ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
8) NEMA National Electrical Manufacturers Association
9) AIA American Insurance Association
10) AWS American Welding Society
11) ASA American Standards Association
12) IEEE Institute of Electrical and Electronics Engineers
13) NEC National Electrical Code
14) NFPA National Fire Protection Association

g. The particular specification shall be identified by appropriate prefix and number only with the latest revision being applicable unless otherwise noted.

2. Fees

a. Pay all required fees.
b. Pay royalties or fees required in connection with the use of patented devices and systems.

B. Furnish all materials and equipment new, free from defects and with listings or labels of Underwriter's Laboratories, Inc. or other nationally approved testing laboratory.

C. All items of a given type shall be the product of the same manufacturer.

D. All materials and equipment shall be the product of manufacturers regularly engaged in their manufacture.

1.10 SHOP DRAWINGS

A. Prepare and submit detailed shop drawings for piping work and other distribution services, including locations and sizes of all openings in floor walls and roofs.

B. The work described in any shop drawing submission to be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. Each submitted shop drawing to include a certification that all related job conditions have been checked and that no conflict exists.

C. All drawings to be submitted sufficiently in advance of field requirements to allow ample time for checking. All submittals to be complete and contain all required and detailed information. Shop drawings with multiple parts to be submitted as a package.

D. If submittals differ from the Contract Document requirements, make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.

E. Review of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve the contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the Work. Such review shall not relieve the contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

F. Each shop drawing is to contain the job title, the names and phone numbers of the General Contractor and the contractor, references to the applicable design drawing or specification article, date and scale.

G. Within fifteen (15) days after award of Contract, submit for review, a list of all material and equipment manufacturers whose products are proposed, as well as names of all whom the Contractor proposes to employ.

H. Within three (3) weeks after award of Contract, submit a list of all shop drawings, which shall be submitted in the course of the project. List to show disposition of each item, including date of submission, review, and the like. List to be kept up-to-date throughout entire construction period.

I. Submit shop drawings and manufacturer's data for the following items in accordance with the Contract Documents:

1. Coordinated, detailed shop layout drawings of all mechanical rooms, services and distribution systems, including plans, profiles and sections.
2. Details of piping supports, elbows, anchors and miscellaneous appurtenances.
3. Hangers, supports, inserts, anchors, guides and foundations.
4. Valves.

5. Pressure gauges and thermometers.
6. Corrosion protective coatings.
7. Equipment and piping layouts at 3/8 in. scale for the building.
8. Location and size of sleeves for openings in floors and walls.
9. Certified equipment performance curves for pumps.
10. Schedule of pipe and fittings, materials and application, valves, escutcheons, air vents, valve tags and schedules, strainers, and water specialties.
11. Pump system, including pumps, motors and controllers.
12. Building automation systems including descriptions, instruments, and alarms.
13. Flashing.
14. Equipment identification and certificates.
15. Pressure tanks and accessories.
16. Water heaters and accessories.
17. Plumbing fixture and trim.
18. Other shop drawings and submittals as requested within the specification.

1.11 SAMPLES

A. Submit samples of all items with exposed finishes for review.

B. Allow sufficient time for consideration without interfering with job schedule.

C. Duplicate quality and finish to type to be supplied under contract.

D. Identify similar to shop drawings.

1.12 START-UP

A. Properly lubricate all pieces of equipment.

B. Check and clean all pipes of dirt and debris, including strainers.

C. Prepare each piece of equipment in accordance with manufacturer's installation instructions and have a copy at the equipment.

D. Fill and vent all water systems.

E. Check rotation on each motor.

F. Have representatives of each manufacturer present when hereinafter specified, so that equipment shall be started up by manufacturer.

1.13 ACCESS DOORS IN FINISHED CONSTRUCTION

A. Furnish access doors as required for operation and maintenance of concealed equipment, clean-outs, valves, shock absorbers, controls, etc., and coordinate their delivery with the installing trade.

B. Coordinate and prepare a location, size and function schedule of access doors required and deliver to the Owner and the Architect for review.

C. Doors shall be of a size required for operating and repacking valves, and shall be as manufactured by Karp Associates, Nystrom Inc., or Mifab.

D. Unless otherwise indicated, minimum size to be 18" x 18".

E. Furnish color coded buttons or tabs to indicate location of valves or other equipment located above removable type ceilings where access doors are not required.

F. Access doors shall have a fire rating compatible with the wall construction in which they are located.

1.14 SYSTEM IDENTIFICATION

A. Piping:

1. All piping, exposed or concealed shall be identified as to its service in accordance with OSHA and ANSI Standards by one of the following methods:

   a. Installation of manufactured adhesive band type identification markers, similar to "Quick-Label" by W.H. Brady Company.

2. Piping identification markings shall be installed as follows:

   a. In each room.
   b. All valve locations.
   c. At shaft walls.
   d. Every 40 feet on continuous runs.

3. Valves:

   a. Valves shall be identified by a tag system utilizing brass tags at 2 inch minimum diameter and attached to the valves using brass chain.

      1) The new valve tag identification numbers shall be permanently added to all existing valve tag charts within the building.

4. Equipment:

   a. Identify all controls such as motor starters not in motor control centers, float switches, and alarms.

1.15 OPERATING & MAINTENANCE INSTRUCTION

A. Prepare operating and maintenance instructions manual including operating instructions, maintenance instructions, manufacturer's data, specific equipment data.

B. Provide an alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.

C. Provide operating instructions for complete system, including:

1. Normal starting, operating, and shut-down
2. Emergency procedures for fire or failure of major equipment
3. Summer and winter special procedures
4. Day and night special procedures

D. Provide maintenance instructions, including:

1. Valve tag list and equipment tag list
2. Proper lubricants and lubricating instructions for each piece of equipment, and date when lubricated
3. Required cleaning, replacement and/or adjustment schedule

E. Provide manufacturer's data on each piece of equipment, including:

1. Installation instructions.
2. Drawings and specifications.
3. Parts list, including recommended items to be stocked.
4. Complete wiring and temperature control diagrams.
5. Marked or revised prints locating all concealed parts and all variations from the original system design.
6. Test and inspection certificates.

F. Provide specific equipment data including, but not limited to, the following:

1. For Plumbing Systems:

a. Pumps.
b. Valves.
c. Piping.
d. Accessories.
e. Pressure reducing valves.
f. Water heaters.
g. Water meters.
h. Strainers.
i. Toilet fixtures and supports.
j. Toilet fixture trim.
k. Flow measuring devices.
l. Electric wiring.
m. Pressure tanks.

2. For Automatic Control System:

a. Drawings and description of system controlled.
b. Sequence of operation for each system.

c. Data on components.
d. Wiring and piping, schematic any layout, for panels and panelboards.
e. System operating manual, including set points.

G. Provide instruction of operating personnel.

1. Instruct Owner's operating personnel in proper starting sequences, operation, shutdown, and maintenance procedures, including normal and emergency procedures.
2. Instruction to be by personnel skilled in operation of equipment. Instructions for major equipment to be by equipment manufacturers' representatives.
3. Make arrangements to give instructions by system and not by building areas.
4. Provide five (5) instruction sessions not to exceed six (6) hours each.
5. Instructions on automatic controls to be by manufacturer's representative.

H. Submittals

1. Shop Drawings: Submit three copies for review prior to final issuance.
2. Provide six (6) copies of each operation and maintenance manual.

a. Manuals to be 8-1/2" x 11 size in hard-back, 3-ring loose leaf binders. Use more than one volume if required. Do not overfill binders.
b. Manuals to be completed and delivered to the Engineer for approval at least 20 days prior to instruction of operating personnel.

3. Prepare separate manuals for the Plumbing system.

1.16 TOOLS FOR OPERATION, ADJUSTMENT AND MAINTENANCE

A. Deliver to Owner's representative all special tools needed for proper operation, adjustment and maintenance of equipment.

1.17 Record drawings

A. The contractor shall maintain a complete set of "Record Drawings" reflecting an accurate dimensional record of all work. These drawings shall be marked up to show the precise location of concealed work and equipment, including concealed piping and valves and all changes and deviations in the plumbing work from that shown on the contract drawings. This requirement shall not be construed as authorization for the contractor to make changes in the layout or work without written definite instruction from the Architect or Engineer.

B. Record dimensions shall clearly and accurately delineate the work as installed; location shall be suitably identified by at least two dimensions to permanent structures.

C. The contractor shall stamp all "Record Drawings" and certify for correctness by signing and dating them.

D. Record drawings submitted to Owner shall consist of 1 set of mylars and 1 set of compact disk's (CD's) with all work provided on Autocad 2010 format.

E. Prior to final acceptance, contractor shall submit certified "Record Drawings" to the Architect/Engineer for review and make changes, corrections or additions as noted by Architect/Engineer. After this review, the drawing shall be delivered to the Owner.

PART 2 - ALTERNATES

1. Refer the project manual Specification 01030 Alternates regarding alternate work related to plumbing.

PART 3 - EXECUTION
NOT USED.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 22000

SECTION 220010 - BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Comply with all of the Contract requirements.

1.2 DESCRIPTION OF PIPING

A. Reducing fittings shall be installed at all points where pipe size changes.

B. In vertical lines concentric reducing fittings shall be used.

C. Provide unions in supply and return connections at all equipment, fixture, specialties, automatic valves, screwed end valves and at all other points in the systems where required to facilitate removal of specialties or equipment for repairs.

D. Provide all sleeves, collars, fittings, etc. for complete code compliant system installation.

1.3 PERFORMANCE REQUIREMENTS

A. 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.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS

A. Refer to the following specification sections:

1. 15140, Domestic Water Piping
2. 15150, Sanitary Waste and Vent Piping
3. 15160, Storm Drainage and Piping

2.2 VALVES

A. General

1. All valves used for water, oil, gas and low-pressure steam service shall be designed for a minimum working pressure of 150 lb. Valves 2" and under shall be ball valves, 2-1/2"a over, butterfly or gate type.

2. All valves and appurtenances used for the domestic water system shall be constructed to meet NSF-61.

B. Butterfly or Gate Valves (2-1/2" & Larger)

1. Butterfly or Gate valves shall be one-piece cast iron body, high performance, lug type, 150 psi working pressure, extended neck, aluminum-bronze discs, stainless steel stem and resilient replaceable seat.

2. Butterfly or Gate valves shall be as manufactured by Nibco.

C. Ball Valves (2" & smaller)

1. Water and Heating Hot Water Service

a. Ball valves shall be brass body, lever handle with stop, 316 stainless steel ball and stem, Teflon seat with screwed or solder ends. Ball valves shall be model T-FP - 600A or S-FP-600A series as manufactured by Nibco.

b. Drain valves shall be as above except ¾", Apollo model No. 78-204-01 with stainless steel ball & stem, ¾" hose thread, chain and cap.

c. All ball valves covered with insulation shall be supplied with a stem extension of greater length than the thickness of insulation applied.

2. All ball valves covered with insulation shall be supplied with a stem extension of greater length than the thickness of the insulation applied.

D. Check Valves.

1. Swing check valves 2-1/2" and smaller shall be bronze body with screwed or solder ends, removable bronze seat and Teflon disc.

2. Swing check valves 3" and larger shall be iron body with bronze trim, flanged ends, removable bronze seat and Teflon disc.

3. All swing check valves shall be as manufactured by Lukens, Crane, Stockham or Walworth.

E. Balancing Valves

1. Balancing valves from ½" up to 3" in size shall be of the combination balancing and shutoff type with an adjustable stop, positive shutoff memory stop, drain connection, readout valves to facilitate differential pressure readings, bronze body, brass ball construction with carbon filled TFE seat rings. Valves 4" in pipe size and larger to be cast iron body/brass vane construction. All valves to be provided with factory molded insulation permitting easy access for balance and readout.

2. All balancing valves shall be Circuit Setter "RF" series for flows of 1 GPM and under, & "Circuit Setter Plus" for flows of over 1 GPM as manufactured by Bell and Gossett.

2.3 PIPING SPECIALTIES

A. Backflow Preventer

1. Each assembly shall consist of two (2) independent check valves with intermediate relief valve, strainer, two quarter-turn ball shut-off valves, union fittings at inlet and outlet and bronze body ball valve test cocks.

2. Backflow preventers shall be Watts 3/4" series LF909 with air gap series 909AG. Pipe air gap to 6 inches above floor drain.

B. Pressure Reducing Valve

1. Install pressure reducing valve as indicated on the Drawings.

2. Water-pressure reducing valve for low pressure application, with integral stainless steel strainer, sensitive spring and large diaphragm, bronze body with union on inlet and threaded outlet.

3. Provide with gauge tapping and gauge. Maximum temperature is 200°F. Reduced pressure range is 10 to 35 pounds.

4. Pressure reducing valve shall be 2" model LF25AUB-Z3 as manufactured by Watts. Set pressure to 65 psig.

C. Pressure Relief Valve (water)

1. Water pressure relief valves shall be ASME rated and stamped, shall have a brass body and manual lifting device. Relief valves shall be of size and capacity as indicated on drawings. Pressure Relief valves shall be as manufactured by Bell & Gossett, Lonergan, Kunkle or Watts.

2. All hot water systems with heat exchangers shall be provided with a pressure relief valve sized for the total input of the heat exchanger & 100 psi. Pipe relief valve to 6" above the finished floor.

D. Unions

1. Unions 2" and smaller in ferrous piping shall be ground joint, malleable iron screwed type of the proper service rating.

2. Unions 2-1/2" and larger in ferrous piping shall be made with forged steel welding flanges.

3. Unions in copper tubing smaller than 2" shall be wrought copper, ground joint, with solder ends. Unions 2" and larger shall be cast copper flanged unions with soldered ends.

4. Dielectric unions shall be used where dissimilar metals meet. Where dissimilar flanged joints meet, a bolt isolation kit shall be used. Dielectric union shall be as manufactured Watts.

E. Thermometers (Dial indicating type)

1. All pipe insertion thermometers shall be round (5" diameter) dial indicators, industrial type, range as selected for each application, with stainless steel thermometer wells (Not Brass), and where required, with extension neck to clear insulation.

2. Thermometers located at eye level shall be positioned in a straight form, and above eye level, inclined form.

3. Thermometers shall be model 50 EI = 060 E 63.5 0/120 Deg F as manufactured by Ashcroft.

F. Strainers

1. Strainers shall be of the angle type. 2" strainers and smaller shall have bronze or cast iron bodies and screwed connections. 2-1/2" strainers and larger shall have cast iron bodies and flanged connections. All strainers shall be designed for 125 lbs. working pressure. Strainers for steam condensate service shall be furnished with blow down ball valve, with end capped.

2. Screens shall be stainless steel with a .032 perforation (20 mesh) for steam service and .125" perforation for hydronic and steam condensate service.

3. Strainers shall be as manufactured by Sarco.

Potable Water (2" and smaller)	Model BT, TBT, or IT
Potable Water (2 1/2" and larger)	Model IT (Cast Iron)

G. Gauges

1. Case shall be 4-1/2" in diameter constructed of pressed steel with black, baked enamel finish. Gauge shall be equipped with a clear glass crystal face, and a white faced dial with black numerals and subdivisions for pressure, red for vacuum. Gauges shall be arranged for bottom connection.

2. Gauges shall be equipped with a copper alloy bourdon tube with a brass tip and socket. Movement shall be hard brass with bronze bushings and steel pins. Movement shall be equipped with a recalibrator so that gauge may be reset. Gauges shall be graduated to two (2) times the operating pressure they serve.

3. Gauges used for steam service shall be equipped with a siphon. All gauges shall be provided with a ¼" ball valve (No Gauge Cocks shall be permitted). Gauges used on vibrating or pulsating pressures shall be equipped with snubbers.

4. Gauges shall be as manufactured by Trerice, Weiss, Phila. Thermometer or Marsh.

H. Floor Drains

1. Contractor shall provide drains complete with necessary extensions, flange clamps, deck clamps, membrane clamps as required for the drain installation. All drains in floors with waterproofing membranes shall have membrane clamps and/or quantity of either or both as required for the floor construction.

I. Cleanouts

1. Provide cleanouts of the same size as pipe served up to 4-inch pipe size. For pipes 5 and 6 inch, provide 4-inch cleanout; for pipes 8 inch, provide 6-inch cleanout. Locate cleanouts near the base of each sanitary or storm stack (within 2 feet of floor); at changes in direction of soil, waste, storm and sub-soil pipes that exceed 45 degrees; at intervals not exceeding 50 feet in all straight runs for pipes smaller than 3 inches and not exceeding 100 feet for pipes 3 inches and larger; and elsewhere to comply with local plumbing codes, and the Authority Having Jurisdiction.

2. Cleanout plugs shall be extra heavy brass in compliance with the plumbing code. Extend cleanouts on under-slab piping and bring flush with floor. Cleanout terminations shall have counter-sunk nuts and be so located and installed that they shall be readily accessible. Cleanouts shall have membrane clamp when installed in waterproof slabs.

3. Cleanouts for various floor finishes:

   a. Ceramic, terrazzo, quarry tile, rubber, vinyl, asphalt, linoleum: Cast iron adjustable body, bronze plug, scoriated square secured nickel bronze top. Zurn #ZN-1400-BP-T.

   b. Concrete and unfinished areas: Same as for tile floor, except with Zurn #Z, dura-coated cast iron top.

   c. Vertical piping: Cast iron waste pipe tee with threaded side outlet and bronze threaded plug with counter-sunk head tapped to anchor stainless steel access plate.

Access plate shall be compatible with wall construction. Zurn #Z-1441-BP.

d. Carpet: Same as for tile floor, except with Zurn #-CM, carpet marker.

e. Accessible piping: Cast iron cleanout ferrule and bronze plug Zurn #Z-1440-BP. Vertical pipe ferrule may be in tee fitting; horizontal pipe cleanout shall be in wye fitting.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. The Contractor shall carefully investigate and coordinate conditions affecting this work with other Trades to prevent interference's between architectural, electrical, structural and other mechanical features. All piping shall be kept as close to walls, ceilings and columns as possible.

B. Water Lines - shall be sufficiently graded or pitched to provide complete drainage of the entire system

C. Piping shall not pass in front of, or interfere with any windows, doors or other openings. Head-room under piping in front of windows, doors and other openings shall not be less than the top of the window, door or other opening.

D. All piping shall be installed with adequate clearance to install the specified insulation. Fai to install piping with adequate clearance shall not be an excuse for installing anything other than the specified insulation. It shall be the Contractor's responsibility to reinstall any piping that cannot be properly insulated at no expense to the Owner

E. All piping shall be cut accurately to measurements established at the building site and shall be worked into place without springing or forcing.

F. All threaded piping shall have burrs removed by reaming. The caulking of screwed connections to make them tight shall not be accepted.

G. No piping shall be installed over transformers, switchgear, motor control centers or electrical panels. Where piping is located adjacent to electrical equipment, the maximum clearance possible shall be maintained between piping and electrical equipment.

H. Piping passing through floors or ceilings shall be firestopped.

I. All cooling coil condensate piping shall be sloped at a minimum of 1/8" per foot.

J. All air vents shall be piped with ½" soft copper to nearest drain.

K. Contractor shall keep all piping and equipment free of debris. Provide temporary construction bypass piping where necessary to maintain debris-free.

L. Expansion fittings shall be provided where pipes cross building expansion joints.

M. Contractor shall flush entire system upstream of equipment, open, remove all water, clean inside of equipment free of all debris at final close-in inspection and prior to turn-over to Owner.

3.2 VALVES

A. Drain valves shall be provided at each low point and at the bottom of all piping system risers and equipment for complete drainage.

B. Provide manual ball valve vents and drains at all local high/low points, and pitch piping towards drains so that the system may be completely drained and purged of air.

C. All valves shall be installed with the stem or spindle above the horizontal.

D. Valves shall be installed to isolate any apparatus or equipment installed in the piping systems.

E. All balancing valve memory stops shall be set after all balancing of the systems has been completed.

3.3 PIPING SPECIALTIES

A. Reducers

1. Horizontal water lines shall have eccentric fittings installed so that the top side of the pipe shall continue in the same plane.

3.4 COORDINATION WITH OTHER TRADES

A. Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Architect and Owner) any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Where the work of various trades shall be installed in close proximity to one another, or where there is evidence that the work of one trade shall interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. Prior to the execution, procurement or fabrication of any work, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4-inch = 1-foot 0-inch clearly showing work of all trades. If the Contractor allows one trade to install his work before coordinating with work of other trades, the Contractor shall make necessary changes to correct the condition without *extra charge.*

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 220010

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING

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 the following hangers and supports for mechanical system piping and equipment:

1. Steel 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.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.
5. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."

3. AWS D1.3, "Structural Welding Code--Sheet Steel."

4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 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 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.

2. Carpenter & Paterson, Inc.

3. Empire Industries, Inc.

4. ERICO/Michigan Hanger Co.

5. Globe Pipe Hanger Products, Inc.

6. Grinnell Corp.

7. GS Metals Corp.

8. National Pipe Hanger Corporation.

9. PHD Manufacturing, Inc.

10. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.

2. ERICO/Michigan Hanger Co.; ERISTRUT Div.

3. GS Metals Corp.

4. Power-Strut Div.; Tyco International, Ltd.

5. Thomas & Betts Corporation.

6. Tolco Inc.

7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 FIBERGLASS STRUT SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Champion Fiberglass, Inc.
3. Cope, T. J., Inc.; Tyco International Ltd.
4. Seasafe, Inc.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. 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.

1. Available Manufacturers:

a. Hilti, Inc.

b. ITW Ramset/Red Head.

c. Masterset Fastening Systems, Inc.

d. MKT Fastening, LLC.

e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.

b. Empire Industries, Inc.

c. Hilti, Inc.

d. ITW Ramset/Red Head.

e. MKT Fastening, LLC.

f. Powers Fasteners.

2.8 PIPE STAND FABRICATION

A. Pipe Stands, General: 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.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.

b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

1. Available Manufacturers:

a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.

b. MIRO Industries.

c. Portable Pipe Hangers.

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: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Available Manufacturers:

a. Portable Pipe Hangers.

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 support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.9 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Available Manufacturers:

1. C & S Mfg. Corp.

2. HOLDRITE Corp.; Hubbard Enterprises.

3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, 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 APPLICATIONS

A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.

F. 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 120 to 450 deg F pipes, NPS 4 to NPS 16 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 24 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 2.

10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

11. Extension Hinged or 2-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.

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 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 2 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 20, 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.

G. 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 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. 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.

I. 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.

J. 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.

K. 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 absorb 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 absorb 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 absorb 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.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel 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 building structure.

B. 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 above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

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-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

I. Install hangers and supports complete with necessary 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 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 so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

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 according to ASME B31.1 for power piping and 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 thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 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 contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 220529

SECTION 220533 - HEAT TRACING 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. This Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

1. Plastic insulated, series resistance.
2. Self-regulating, parallel resistance.
3. Constant wattage.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

B. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

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. BH Thermal Corporation.
2. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
3. Delta-Therm Corporation.
4. Easy Heat Inc.
5. Nelson Heat Trace.
6. Pyrotenax; a division of Tyco Thermal Controls.
7. Raychem; a division of Tyco Thermal Controls.
8. Thermon Manufacturing Co.
9. Trasor Corp.

B. Heating Element: Pair of parallel No. **16**] AWG, **nickel-coated** stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

C. Electrical Insulating Jacket: Flame-retardant polyolefin.

D. Cable Cover: Stainless-steel braid, and polyolefin outer jacket with UV inhibitor.

E. Maximum Operating Temperature (Power On): 150 deg F.

F. Maximum Exposure Temperature (Power Off): 185 deg F.

G. Maximum Operating Temperature: 300 deg F.

H. Capacities and Characteristics:

1. Maximum Heat Output: 12 W/ft.
2. Piping Diameter: 2-inch
3. Volts: 120V.
4. Phase: Single.
5. Hertz: 60.

2.2 CONTROLS

A. Pipe-Mounting Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Division 22 Section "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Freeze protection for Domestic Water: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install insulation over piping with electric cables according to Division 22 Section "Plumbing Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

C. Set field-adjustable switches and circuit-breaker trip ranges.

D. Protect installed heating cables, including nonheating leads, from damage.

3.4 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.

1. Test cables for electrical continuity and insulation integrity before energizing.
2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 22 0533

SECTION 220700 - PLUMBING INSULATION

PART 1 – GENERAL

1.1 SUMMARY

A. Comply with all of the Contract requirements.

1.2 DESCRIPTION OF INSULATION WORK

The Contractor shall provide all labor, equipment, materials and accessories necessary for the insulation of all piping and equipment not factory insulated.

A. All new domestic hot & cold water piping.

B. All insulation shall be installed in a workmanlike manner, and in complete conformance with the Manufacturer's recommendations and instructions, by skilled workmen regularly engaged in this type of work.

C. Insulation materials furnished shall meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1 "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).

D. Materials - all insulation and accessories shall have composite (insulation, jacket and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard Ratings as tested under procedure ASTM E-84, NFPA 255 and UL 723, not exceeding : Flame Spread 25; Smoke Developed 50.

PART 2 – PRODUCTS

2.1 GENERAL

A. Inserts between the pipe and pipe hanger shields shall consist of rigid calcium silicate pipe insulation and/or heavy density insert, and shall be provided with vapor barrier.

2.2 MANUFACTURER

A. All pipe and equipment insulation shall be as manufactured by:

Fiberglass	John Manville, Schuller, Owns-Corning or Knauf.	
Flexible Elastomeric	Armaflex , AeroCel	
Insulation Adhesives	Foster Vis. Amchem	InsulCoustic/Birma
	Prod. Epolux Mfg.	Childers Products

2.3 PIPING

A. All pipe insulation shall be one piece fibrous glass unless otherwise indicated on Drawings, with "K" .23 at 75° F. mean temperature. The insulation shall be jacketed with an embossed white kraft reinforced, foil vapor barrier such as Owens-Corning ASJ/SSL-II. The jacket shall have double factory attached, self-sealing adhesive strips. Butt joint strips shall be pressure sensitive and firmly sealed in place. No staples or bands are needed with OCF SSL-II.

B. Insulation jackets, facings, adhesives, coatings and accessories to be fire hazard rated by Underwriter Laboratories, Inc., Steiner Tunnel Test Method for Fire Hazard Classification for Building Materials, Standard UL 723 (ASTM E-84) (NFPA 225) (ASA A2.5-1963).

Flamespread: maximum 25

Fuel contributed and smoke developed: maximum 50

Flameproof treatments subject to deterioration due to moisture or humidity are unacceptable.

Underwriters Laboratories, Inc. listing.

C. All fittings, valves and flanges on piping shall have molded or segmental fiberglass insulation equal to insulation applied to adjoining piping, continuous one piece polyvinyl chloride fitting covers.

2.4 ADHESIVES AND COATINGS

A. Similar to Foster Product names and figure numbers as follows :

Lagging adhesive : 30-04 UL label

Vapor barrier coating : "Tite fit" 30-35 UL label

Vapor seal adhesive : Spark-fas 85-20 UL label

Duct adhesive : Spark-fas 85-20 UL label

Outdoor mastic : Seal-fas G-P-M 35-00 UL label

Asphalt mastic : C.I. Mastic 60-25

B. Application of Adhesives, Etc.:

Apply at following rates in accordance with Manufacturer's recommendation:

Lagging adhesive :	60 sq. ft./gal
Vapor barrier coating :	50 sq. ft./gal
Duct adhesive :	100 sq. ft./gal
Pre-sized glass cloth :	100 sq. ft./gal
Outdoor mastic (vinyl, acrylic or polymer):	12 sq. ft./gal
Asphalt mastic :	12 sq. ft./gal

Adhere jackets and facings with wet coat of adhesive. Lap sealing full width of lap. Surfaces to be adhered to must be completely coated with adhesive.

2.5 WIRE BANDING AND FASTENING DEVICES

A. Bands, ¾" nominal width with wing seals, minimum thickness as follows:

Aluminum: .007", where exposed to weather .020"

Stainless steel: .010"

PART 3 – EXECUTION

3.1 GENERAL

A. Insulation shall be applied only after all piping, and equipment have been tested. Insulation shall be applied to clean, dry surfaces.

B. All insulation shall butt tightly up to all wall and floor penetrations.

C. Insulation for strainers and other equipment, where it is necessary to remove or disturb the insulation, shall have the insulation installed so that it is easily removed to facilitate cleaning and service of the equipment or strainer.

D. Inserts shall be installed at all insulated pipe hanger shields.

3.2 PIPING INSULATION SCHEDULE

A. Piping systems shall be insulated as follows:

Service	Pipe Size	Insulation Thickness
Domestic Water (hot & cold) (Fiberglass)	1" or greater	1"
Domestic Water (hot & cold) (Fiberglass)	under 1"	1"
Horizontal Storm piping (Fiberglass)		1/2"

B. All domestic water piping insulation shall have a minimum R-value of 4.

3.3 PIPING INSTALLATION

A. Flanges to be insulated with same material as pipe insulation, covering flange and overlapping insulation on adjacent piping. All exposed ends on insulation shall be sealed with insulating cement.

B. At all pipe hangers, calcium silicate and or heavy density insulation inserts and shields shall be installed. Hangers shall not be imbedded in insulation.

C. Pipe fitting insulation under fiberglass covers: Loops of wire are to be used to secure mitered segments of insulation, prior to installation of fiberglass covers.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

C. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Water meters.
6. Backflow preventers and vacuum breakers.
7. Water penetration systems.

D. Water Samples: Specified in "Cleaning" Article.

E. 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 hydronic piping.

F. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.

2. Do not proceed with interruption of water service without Owner's written permission.

1.6 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.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

2.5 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.

B. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.6 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.7 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. 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.
d. Or approved equal.

2. Description:

a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.

b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Colonial Engineering, Inc.
b. NIBCO Inc.
c. Spears Manufacturing Company.
d. Or approved equal.

2. Description:

a. CPVC or PVC four-part union.
b. Brass or stainless-steel threaded end.
c. Solvent-cement-joint or threaded plastic end.
d. Rubber O-ring.
e. Union nut.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International.
e. Matco-Norca.
f. McDonald, A. Y. Mfg. Co.
g. Watts; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn Company.
i. Or approved equal.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F 150 psig 250 psig.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Matco-Norca.
d. Watts; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn Company.
f. Or approved equal.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
e. Or approved equal.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

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. Elster Perfection Corporation.
b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Matco-Norca.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.
f. Or approved equal.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

2.9 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.

2.10 FLEXIBLE CONNECTORS

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. 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. Or approved equal.

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.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

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 for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

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 to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: 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. Apply primer.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Piping: Join according to ASTM D 2855.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

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 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. 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. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

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 nipples.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

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.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

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 that required by plumbing code.

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.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. 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.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Repeat procedures if biological examination shows contamination.

e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.

B. Water Distribution Piping Below Ground: Use the following:

1. 4 to 12 Inches: Ductile-iron pipe, ductile-iron or gray-iron fittings, rubber gaskets, and push-on or mechanical joints.

2. 3 Inches and Smaller: Soft copper tube, Type K, cast-copper-alloy solder-joint pressure fittings, and soldered joints with Alloy Sn95 solder.

C. Water Distribution Piping Above Ground: Use the following:

1. 3 Inches and Smaller: Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.

a. Fittings Option: Mechanically formed outlets, brazing filler alloy, and brazed joints.

D. Indirect waste piping: Use the following:

1. Type "L" copper - above ground

2. Cast iron hub & spigot - below ground

Note: Schedule 40 PVC permitted only when approved by local authorities having jurisdiction. PVC not permitted in air plenums.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Trap-seal primer valves.
12. Trap-seal primer systems.

B. Related Requirements:

1. Section 221116 "Domestic Water Piping".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, 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."

C. LEAD FREE Compliance per "THE FEDERAL "REDUCTION OF LEAD IN DRINKING WATER ACT" AS DEFINED PER SDWA IN SECTION 1417(D)." The wetted area exposed to drinking water shall be lead free.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/2 or NPS 3/4.

4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Chrome plated.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Armstrong International, Inc.
   b. Cash Acme; a division of Reliance Worldwide Corporation.
   c. Conbraco Industries, Inc.
   d. Honeywell International Inc.
   e. Legend Valve.
   f. Leonard Valve Company.
   g. Powers; a division of Watts Water Technologies, Inc.
   h. Symmons Industries, Inc.
   i. TACO Incorporated.
   j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
   l. Or approved equal.

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 union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: See plans.
9. Tempered-Water Design Flow Rate: See plans.
10. Valve Finish: Chrome plated or rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Armstrong International, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. Powers; a division of Watts Water Technologies, Inc.
   e. Symmons Industries, Inc.
   f. Or approved equal.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psigminimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.

6. Connections: Threaded inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: See plans.
9. Tempered-Water Design Flow Rate: See plans.
10. Selected Valve Flow Rate at 45-psig Pressure Drop: See plans.
11. Pressure Drop at Design Flow Rate: See plans.
12. Valve Finish: Chrome plated.
13. Piping Finish: Chrome plated.
14. Cabinet: Factory fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.

2.6 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: 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: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze or chrome plated.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet: Concealed.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze or chrome plated.
9. Vacuum Breaker:

   a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.

10. Operating Keys(s): Two with each wall hydrant.

C. Vacuum Breaker Wall Hydrants:

1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
4. Pressure Rating: 125 psig.
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4.
8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.8 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.

2.9 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Precision Plumbing Products, 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.
   i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
   j. Or approved equal.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. MIFAB, Inc.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   f. Or approved equal.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   b. Or approved equal.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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 unacceptable for this application.

3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.

F. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

G. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

H. Install water-hammer arresters in water piping according to PDI-WH 201.

I. 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.

J. 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.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

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. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 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. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
5. Water pressure-reducing valves.
6. Calibrated balancing valves.
7. Primary, thermostatic, water mixing valves.
8. Primary water tempering valves.

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."

3.5 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.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. 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/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74,Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.
d. Matco-Norca, Inc.
e. MIFAB, Inc.
f. Mission Rubber Company; a division of MCP Industries, Inc.
g. Stant.
h. Tyler Pipe.
i. Or approved equal.

2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.
b. Clamp-All Corp.
c. Dallas Specialty & Mfg. Co.
d. MIFAB, Inc.

e. Mission Rubber Company; a division of MCP Industries, Inc.
f. Stant.
g. Tyler Pipe.
h. Or approved equal.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Unshielded, Nonpressure Transition Couplings:

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) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.
4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
5) Or approved equal.

b. Standard: ASTM C 1173.

c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

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) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.
3) Or approved equal.

b. Standard: ASTM C 1460.

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. 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.

K. 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 or 2 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.

L. 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."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground ABS piping according to ASTM D 2661.

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground ABS and PVC piping according to ASTM D 2321.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. 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.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded or shielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to 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. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
   Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

K. Install supports for vertical ABS and PVC piping every 48 inches.

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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Install horizontal backwater valves with cleanout cover flush with floor.

6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 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.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
3. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.
7. Trench / Slot drains.
8. Through-penetration firestop assemblies.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease and oil interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.

e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Or approved equal.

2. Standard: ASME A112.14.1.

3. Size: Same as connected piping.

4. Body: Cast iron.

5. Cover: Cast iron with bolted or threaded access check valve.

6. End Connections: Hub and spigot Hub and spigot or hubless Hubless.

7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed open for airflow unless subject to backflow condition.

8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.
e. Or approved equal.

2. Size: Same as floor drain outlet.

3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.

4. Check Valve: Removable ball float.

5. Inlet: Threaded.

6. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.

e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Or approved equal.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.

5. Closure: Countersunk Countersunk or raised-head Raised-head, brass cast-iron plastic plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. Oatey.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Light Commercial Operation.
h. Zurn Plumbing Products Group; Specification Drainage Operation.
i. Or approved equal.

2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.

3. Size: Same as connected branch.

4. Type: Adjustable housing Cast-iron soil pipe with cast-iron ferrule.

5. Body or Ferrule: Cast iron.

6. Clamping Device: Required.

7. Outlet Connection: Threaded.

8. Closure: Brass plug with straight threads and gasket Brass plug with tapered threads.

9. Adjustable Housing Material: Cast iron Plastic with threads set-screws or other device.

10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

11. Frame and Cover Shape: Round.

12. Top Loading Classification: Heavy Duty.

13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Or approved equal.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.

5. Closure: Countersunk or raised-head, drilled-and-threaded 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, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Commercial Enameling Co.
b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Prier Products, Inc.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products Inc.
h. Zurn Plumbing Products Group; Light Commercial Operation.
i. Zurn Plumbing Products Group; Specification Drainage Operation.
j. Or approved equal.

2. Standard: ASME A112.6.3 with backwater valve.

3. Pattern: Floor drain.

4. Body Material: Gray iron.

5. Seepage Flange: Required.

6. Anchor Flange: Required.

7. Clamping Device: Required.

8. Outlet: Bottom Side.

9. Backwater Valve: Drain-outlet type.

10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

11. Sediment Bucket: Not required.

12. Top or Strainer Material: Bronze Gray iron Nickel bronze.

13. Top of Body and Strainer Finish: Nickel bronze Polished bronze Rough bronze.

14. Top Shape: Round.

15. Dimensions of Top or Strainer: (See Drawings).

16. Top Loading Classification: Heavy Duty.

17. Funnel: Not required.

18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

19. Trap Material: Bronze Cast iron Copper.

20. Trap Pattern: Deep-seal or P-trap Standard.

21. Trap Features: Trap-seal primer valve drain connection.

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.
   c. Or approved equal.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, 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 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch 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.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.7 TRENCH / SLOT DRAINS

A. Trench Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Or approved equal.

2. Standard: ASME A112.6.3 for trench drains.

3. Material: Ductile iron.

4. Flange: Not required.

5. Clamping Device: Not required.

6. Outlet: Bottom.

7. Grate Material: Stainless Steel plated Ductile iron.

8. Top Loading Classification: Extra Heavy Duty.

9. Trap Material: Stainless steel not required Insert material.

B. Slot Drains:

1. Description: Grateless slot drain 1" opening, casted in concrete. Drain bodies are made of Fiber Reinforced fiberglass or stainless steel, with interlocking ends, and radiused bottom . The surfacing areas and drain frame is made from T304 Stainless steel. Include cleaning paddle for each system and hanger, stainless steel sump, end caps, sump adaptor plate, removable silt strainer reinforced sump lid. Drain Channels are built with a .5% built-in slope and inverts commence at 5.5" to unlimited length.

2. Shop drawings: Provide dimensioned shop drawings and installation layout with inverts for field coordination with all trades.

3. 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. Slot Drain Systems
b. Norstar's U-drain
c. MIFAB, Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.
e. Or approved equal.

2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.

b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 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 the riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counter-flashing-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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install 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.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. 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.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Assemble open drain fittings and install with top of hub 1 inch or 2 inches above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. 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.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.

2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.

3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.

4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "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.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 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.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 221319

SECTION 22 1329 - SANITARY SEWERAGE PUMPS

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. Submersible sewage pumps.
2. Wet-pit-volute sewage pumps.
3. Sewage-pump basins and basin covers.
4. Packaged, submersible sewage-pump units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PACKAGED, SUBMERSIBLE SEWAGE-PUMP UNITS

A. Packaged, Submersible, Grinder, Sewage-Pump Units:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

   a. Barnes; Crane Pumps & Systems.
   b. Environment One Corporation.
   c. Goulds Pumps; ITT Corporation.
   d. Liberty Pumps.
   e. McDonald, A. Y. Mfg. Co.
   f. Pentair Pump Group; Myers.
   g. Zoeller Company.

2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, grinder, sewage-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron.
5. Impeller: Stainless-steel grinder, cutter, or slicer type with shredding ring.
6. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
7. Control: Manufacturer's standard panel for one pump.
8. Controls: Automatic, with mechanical- or mercury-float switches and alternator.
9. Basin: Watertight plastic and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.

B. Submersible, Quick-Disconnect, Grinder Sewage Pumps:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

   a. ABS Pumps Inc.
   b. Alyan Pump Company.
   c. Barnes; Crane Pumps & Systems.
   d. BJM Pumps, LLC.
   e. EBARA Fluid Handling.

f. HOMA Pump Technology Inc.
g. Liberty Pumps.
h. Pentair Pump Group; Hydromatic Pumps.
i. Stancor, Inc.
j. Tsurumi America, Inc.
k. Vaughan Co., Inc.
l. Weil Pump Company, Inc.
m. WILO-EMU USA LLC.
n. Zoeller Company.

3. Description: Factory-assembled and -tested, grinder sewage-pump unit with guide-rail supports.
4. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
5. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail supports.
6. Impeller: Bronze or stainless steel; statically and dynamically balanced, with stainless-steel cutter, grinder, or slicer assembly; capable of handling solids; and keyed and secured to shaft.
7. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
8. Seal: Mechanical.
9. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
10. Controls:
    a. Enclosure: NEMA Type 4X.
    b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
    e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
11. Control-Interface Features:
    a. Remote Alarm Contacts: For remote alarm interface.
12. Guide-Rail Supports:
    a. Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
    b. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
    c. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
    d. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.

e. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
f. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
g. Lifting Cable: Stainless steel; attached to pump and cover at manhole.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Division 31 Section "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

3.3 INSTALLATION

A. Pump Installation Standards:

1. Comply with HI 1.4 for installation of centrifugal pumps.
2. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.

B. Equipment Mounting: Install progressing-cavity sewage pumps on vibration isolation equipment base. Comply with requirements specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

C. Wiring Method: Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D. 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.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train] Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 22 1329

SECTION 223300 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes:

1. Electric domestic water heaters.

1.2 SUBMITTALS

A. Submit for Review:

1. Product Data: Include manufacturer brochures, diagrams, standard schedules, performance and design data, instruction that illustrate physical size, appearance capacity and other characteristics of materials and equipment.

   a. Clearly mark each copy to show applicable choices and options.
   b. Clearly identified products, equipment and material submitted by detailed number.
   c. Highlight or otherwise indicate deviations from Contract Documents.

2. Field Quality Control Reports: Submit test reports, including nonconforming work and remedial actions taken.

3. Certifications: Operation and Testing.

4. Warranty certificate.

5. Operation and Maintenance Data: Include manufacturer's installation instructions, and operation and maintenance data.

1.3 WARRANTY

A. Furnish manufacturer's warranty that:

1. For one year after Date of Substantial Completion, manufacturer will pay for material, labor, and freight needed to repair or replace failed part(s) of the heater.

2. Submit manufacturer's warranty certificate.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise specified, provide similar items not furnished as an integral part of equipment from one manufacturer.

B. Provide equipment and materials as manufactured by the following:

1. Valves: See Section 220010

2. Gages and Thermometers: See section 220010

3. Insulation: See Section 220700.

4. Bronze Fittings: See Section 221316: Flagg Co., Walworth Co., N.Y. Brass Foundry.

5. Pipe Supports and Hangers - See Section 220529

2.2 ELECTRIC HOT WATER HEATERS

A. Approved Manufacturers: Subject to conformance to requirements, provide products of:

1. Design Basis: Bradford White.

2. State.

3. A.O. Smith.

B. Description

1. Commercial electric storage type heater, with storage and capacity as indicated on Drawings.

2. Provide glass-lined steel tank having:

a. Magnesium anode rod.
b. Outer baked enamel steel jacket.
c. 2 inch glass fiber insulation.
d. Non-corroding pipe nipples for hot and cold water and relief valve connections.
e. Hose threaded drain valve.
f. Inner cold water tube
g. 150 lb. working pressure.
h. Upper and lower immersion heating elements.

3. Unit shall be UL listed and shall carry a 3-year full replacement guarantee.

a. Provide water heater with electrical characteristics, size and recovery rate of heater as indicated on the Drawings.
b. Provide control compartment containing:

1) Adjustable thermostat.
2) Manual reset high temperature cutoff
3) Terminal strips.
4) Fuse block and fuses for control transformer.
5) Sequencer and interlock switch to energize heating elements in stages.
6) Contactors for heating elements

7) Fuse blocks and fuses for heating element circuits.

c. Provide unit completely factory-wired.
d. Provide approved, suitable ASME temperature and pressure type relief valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions, in locations as indicated on Drawings.

3.2 ELECTRIC WATER HEATERS

A. Provide valved water connections, drain, and relief valve piping.

3.3 TESTING

A. After installation, verify that water heaters are operational, all heating elements are working, and that outlet water temperature is at value indicated on Drawings.

B. Measure and record electric current at each heating element.

C. Submit test report.

PART 4 – PAYMENT

4.01 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide all plumbing fixtures, fittings, trim, and accessories shown on the drawings, as required by the State and local codes, the Authority Having Jurisdiction, and as specified herein.

1.3 QUALITY ASSURANCE

A. Basis of Design: As indicated on the drawings. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers shall be acceptable: American Standard, Kohler, Lasco, Oatey, L&M Cultured Marble Co., Elkay, Fiat, Alsons, Just Manuf. Co., Delta, Simmons, Chicago Faucets, Josam, Smith, Wade, Zurn, Crane, Moen, Sloan, Speakman, McGuire, Crane, EBC.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Fixtures.
2. Fixture trim.
3. Faucets.
4. Drains, traps, escutcheons.
5. Accessories.
6. Water supplies.

B. Quality Control Submittals:

1. Manufacturer's installation instructions and mounting dimensions.
2. Dimensioned fixture location plan.

C. Contract Closeout Submittals:

1. Operating and maintenance manual data for the following items. Include product data submittals, routine servicing requirements, diagrams and parts lists.

a. Faucets.

b. Water supply stop valves.

2. Record drawings of the following items:

a. Fixture schedule.

b. Fixture groupings, piping plan, supply, waste, vent.

3. Product warranties on the following items:

a. Fixtures and fixture finishes.

b. Faucets.

PART 2 – PRODUCTS

2.1 GENERAL

A. Vitreous ware for fixtures shall be first-quality new china of even color and without visible defects. Enamelware shall be constructed of smooth, sound, iron casting, finished with high temperature enamel and without visible defects.

B. Plumbing fixtures shall be provided complete with all required supply, waste, soil and vent connections, together with all fittings, supports, fastening devices, cocks, valves, traps, and escutcheons.

C. All exposed supply and waste piping and accessories, including nipples, shall be chrome plated. All exposed traps and tailpieces shall be chrome plated.

D. All water supplies to fixtures shall have stop valves. Loose key valve handles shall not be acceptable.

E. Single lever handle faucets with clear indication of hot and cold regions.

2.2 FIXTURES

A. Refer to plumbing fixture specifications on drawings for basis of design.

B. All lavatory faucets, flush valves, tank-type toilets shall be Water Sense listed and labeled.

PART 3 – EXECUTION

3.1 GENERAL

A. Except as may be described in Part 2 of this Section and that which follows, refer to the applicable provisions of Division 15.

B. Inspection: Prior to the work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where

installation may properly commence.

C. Complete the work of this section in strict accordance with all pertinent codes and regulations, and in compliance with the Authority Having Jurisdiction.

D. Exposed supply piping and accessories, nipples, traps and tailpieces shall be polished chrome-plated.

E. Backing: Provide adequate and suitable backing for plumbing fixtures. Provide all necessary grout and backing material to eliminate voids between fixtures and wall, and to ensure ample bearing.

F. Mounting Height: Dimensions shown on the drawings to rims, etc., are based on the product designated as the Basis of Design. Other manufacturers may have different mounting heights. Install all fixtures using the manufacturer's dimensions unless directed otherwise by the Architect.

G. Fixture Support: All fixtures and equipment shall be supported and fastened in a substantial manner. Secure to concrete or brick walls with brass bolts or machine screws in lead sleeve type anchors or with brass expansion bolts. Expansion bolts shall be of sufficient size and length to suit fixture and shall extend at least 3 inches into concrete or brick work and be fitted with loose tubing or sleeve of proper length to bring expansion sleeves into the concrete or brick wall. Where secured to concrete block or partitions, they shall be fastened with approved toggle or through bolts of sufficient size and length to suit partition thickness and the fixture supported. Use carriers at stud wall construction.

H. Install counter-mounting fixtures in and attached to casework. Provide all required fasteners and clips per manufacturer's requirements. Seal fixture to casework with approved plumber's putty to create a permanent water tight bond.

I. Color and Finish: Refer to plumbing fixture schedule for color and finishes of fixtures. Where enameled cast iron fixtures are specified, the enamel shall be acid resisting. All exposed metal trim on all fixtures shall be brushed nickel.

J. Connections to Equipment: Make waste, vent, water and electrical connections to fixtures and equipment.

K. Wrist handle blades on lavatory faucets shall clear soap dispensers.

L. Provide ADA insulation on supplies, traps and tailpieces for accessible sinks and lavatories. ADA insulation shall be TRUBRO LAV GUARD 2.

M. Provide split-ring escutcheons for piping at wall and floor penetrations.

N. Fixtures with finish defects, damage or blemishes shall not be accepted.

O. Inspection: Verify that all parts are properly furnished and installed, that all adjustments have been made and equipment is clean. Particular attention shall be given to flush valve installations to assure a tight fit and proper operation with no "loose-play."

PART 4 – PAYMENT

4.01 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 224000

SECTION 230001 - GENERAL PROVISION FOR HVAC WORK

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work in this Section includes the providing of labor, materials, equipment and services necessary for a complete and safe installation in accordance with the contract documents and all applicable codes and authorities having jurisdiction for the following:

1. PIPING.
2. HOT WATER SYSTEM.
3. FAN COIL SYSTEM.
4. PACKAGED ROOF-TOP UNITS.
5. AIR COOLED CONDENSER SYSTEM (FOR SPLIT DX SYSTEM).
6. SHEET METAL WORK.
7. AIR HANDLING SYSTEM EQUIPMENT.
8. AIR DISTRIBUTION SYSTEM EQUIPMENT.
9. HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS.
10. INSULATION.
11. MOTORS.
12. MOTOR CONTROLLERS.
13. AUTOMATIC CONTROL SYSTEM.
14. VIBRATION ISOLATION.
15. NOISE CONTROL.
16. THERMOMETERS, GAUGES, AND RECORDING INSTRUMENTS.
17. BALANCING AIR AND WATER SYSTEMS.

B. Provide cutting and patching, except as noted in "AIA Document A210" and "Supplementary Conditions for Mechanical and Electrical Work."

C. Provide piping from plumbing terminations, 10 ft from equipment, for water, gas, compressed air and as indicated.

D. Provide drainage from noted equipment to floor drains, roof, sink, or funnel drains.

1.2 PERMITS AND REGULATIONS

A. Mechanical contractor and plumbing contractor shall obtain, fill-out, sign and seal permit application and will submit and pay permit costs. Contractor shall prepare specific plans as required by proper Authorities before their acceptance of the work. Each Contractor will be responsible and pay for his own fire permits, open flame permits, etc. required by Local and State Fire Regulations governing use of burning tools, etc. Contractor shall cooperate with local enforcement agency in all required or requested inspections, and will notify the Construction Manager of inspection schedules.

B. All materials, equipment and workmanship shall comply with all pertinent State, County and Municipal Laws and the requirements of such regulatory bodies as:

International Mechanical Code (2009)
International Fuel Gas Code (2009)
National Standard Plumbing Code (2009)
International Plumbing Code (2009)
Philadelphia Plumbing Code (2010)
National Sanitation Foundation
International Building Code (2009)
New Jersey Rehabilitation Subcode N.J.A.C. 5:23-6
National Electric Code (NEC 2008)
International Energy Conservation Code (2009)
ASHRAE 90.1 (2007)
ANSI A117.1 Barrier Free Subcode
National Fire Protection Association (NFPA)
Air Conditioning and Refrigeration Institute (ARI)
Air Diffusion Council (ADC)
American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
Associated Air Balance Council (AABC)
American Society of Mechanical Engineers (ASME)
American Society for Testing and Materials (ASTM)
National Electric Manufacturers Association (NEMA)
Underwriters Laboratories (UL)

C. Where the provision of the Specifications or Drawings conflict with the applicable Codes, Rules or Regulations, the Codes, Rules and Regulations shall govern. Contractor shall report any discrepancies between applicable Codes and/or Regulations, and the Drawings and Specifications to the Construction Manager and obtain directions for procedure prior to commencing work.

D. Changes to the Drawings, Specifications or installed work to comply with Codes and Regulations shall be made by the Contractor at no additional cost.

E. Final certificate of inspection and approval of installations by Authorities having jurisdiction shall be delivered to the Construction Manager as a condition of, and prior to, receiving final payment for work under this Contract.

1.3 RELATED WORK AND REQUIREMENTS

A. Work Not Included:

1. Providing finish painting (for non-mechanical equipment).
2. Installing access door and providing filler for finished walls, ceilings and floors.
3. Providing access doors in concrete for access to fuel-oil tanks.
4. Providing trench covers and frames.
5. Providing chimney cleanout door and thimble.
6. Cutting and patching, except as noted in "AIA Document A201" and "Supplementary Conditions for Mechanical and Electrical Work."
7. Providing louvers in doors.
8. Providing undercut doors.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications, in general, describe quality and character of materials and equipment.

B. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation. Provide additional offsets, fittings, hangers, supports, valves, drains as required for construction and coordination with work of other trades.

C. Scaled and indicated dimensions are approximate and are for estimating purposes only. Before proceeding with work, check and verify all dimensions.

D. Where variances occur between the Drawings and the Specifications or within either document itself, the items or arrangement of better quality, greater quantity, or higher cost shall be included in the contract price. The Contractor shall request clarification in writing from the Architect on which item and manner in which the work shall be installed.

E. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

F. Typical details, where shown on the drawings, apply to each and every item of the project where such items are applicable. Typical details are not repeated in full on the plans, and are diagrammatic only, but with the intention that such details shall be incorporated in full.

G. If any part of Specifications of Drawings appears unclear or contradictory, consult Architect and/or Engineer for interpretation and decision as early as possible during bidding period. Do not proceed with work without the Architect's and/or Engineer's decision. If no consultation with Architect and/or Engineers has taken place, prior to bid submissions, contractor shall bid project to include the most expensive and/or stringent of the solutions.

1.5 DEFINITIONS

A. "Provide": to supply, install and make complete, safe, and operable, the particular work referred to unless specifically indicated otherwise.

B. "Install": to erect, mount and make complete with all related accessories.

C. "Furnish" or "supply": to purchase, procure, acquire, and deliver complete with related accessories.

D. "Work": includes labor, materials, equipment, services, and all related accessories necessary for the proper and complete installation of complete systems.

E. "Piping": includes pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and all related accessories.

F. "Wiring": includes raceway, fittings, wire, boxes, and all related accessories.

G. "Concealed": not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceilings, trenches, crawl spaces, or enclosures.

H. "Exposed": in view, not installed underground or "concealed" as defined above.

I. "Indicated," "shown," or "noted": as indicated, shown or noted on drawings or specifications.

J. "Similar" or "equal": of base bid manufacturer, equal in quality, materials, weight, size, performance, design and efficiency of specified product, conforming with "Base Bid Manufacturers."

K. "Reviewed," "satisfactory," "accepted," or "directed": as reviewed, satisfactory, accepted, or directed by or to Architect and/or Engineer.

L. "Motor Controllers": includes manual or magnetic starters with or without switches, individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

M. "Control or Actuating Devices": includes automatic sensing and switching devices such as thermostats, pressure, float, flow, electro-pneumatic switches and electrodes controlling operation of equipment.

1.6 QUALITY ASSURANCE

A. All equipment and accessories shall be the product of manufacturers regularly engaged in their manufacture. All items of a given type shall be the products of the same manufacturer.

B. Furnish all equipment and accessories new and free from defects.

C. All electrical equipment shall be listed by Underwriters' Laboratories, Inc. (UL) or bear UL labels.

D. Supply all equipment and accessories in complete compliance with and in accordance with the applicable standards listed in reference standards of this Section and will all applicable national, state and local codes.

1.7 JOB CONDITIONS

A. Inspection of Site Conditions:

1. Before starting work, visit the site and examine the conditions under which the work has to be performed. Report in writing, to Architect/Engineer, any conditions which might adversely affect the work.

B. Connections to existing work:

1. Install new work and connect to existing work with minimum interference to existing facilities.

2. Provide temporary shutdown of existing services at no additional charges and only with written consent of Owner. Schedule shutdowns not to interfere with normal operation of existing facilities.

3. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.

4. Connect new work to existing work in neat and acceptable manner. Restore existing disturbed work to original condition.

C. Removal and relocation of existing work.

1. Disconnect, remove, or relocate HVAC material, equipment, and other work noted and required by alterations, modifications, or changes in existing construction.

2. Provide new material and equipment required for relocated equipment.

3. Plug or cap active piping of ductwork behind or below finish.

4. Dispose of removed HVAC equipment unless directed otherwise.

1.8 REFERENCE STANDARDS

A. Published specifications, standards tests, or recommended methods of trade, industry or governmental organizations apply to work in all Sections as noted below:

1. ASHRAE - American Society of heating, Refrigerating and Air Conditioning engineers.

2. AABC - Associated Air Balance Controls.

3. AMCA - Air Moving and Conditioning Association.

4. ADC - Air Diffuser Council.

5. NEMA - National Electrical Manufacturers' Association.

6. ANSI - American National Standards Institute.

7. ASME - American Society of Mechanical Engineers.

8. ASTM - American Society for Testing and Materials.

9. NFPA - National Fire Protection Association.

10. ARI - Air-Conditioning and Refrigeration Institute.

11. UL - Underwriters' Laboratories, Inc.

12. OSHA - Occupational Safety and Health Administration Regulations.

1.9 SUBMITTALS

A. Submit shop drawings product data, samples and certificates of compliance required by contract documents, "AIA Document 201" and "SUPPLEMENTARY CONDITIONS FOR MECHANICAL AND ELECTRICAL WORK."

B. Operating instructions, maintenance manuals and parts lists.

1. Provide five sets of manufacturer's equipment brochures and service manuals consisting of the following:

a. Descriptive literature for equipment and components.

b. Model number and performance data.

c. Installation and operating instructions.

d. Maintenance and repair instructions.

e. Recommended spare parts lists.

2. Assemble manufacturers' equipment manuals in chronological order following the specifications' numbering system using heavy duty three ring binders.

3. Submit valve tag chart.

4. Submit three sets of field test reports including instrument set points and normal operating valves.

1.10 COMPOSITE COORDINATION DRAWINGS

A. The Contractor shall prepare full coordinated composite drawings for the mechanical, electrical and fire protection trades. The Contractor shall overlay each trade's work (in separate colors) on a set of sheetmetal shop drawings. All conflicts and potential conflicts shall be clearly identified on the sheetmetal shop drawings. This shall include but not be limited to conflicts with lights, equipment, piping, ductwork and supports of other trades, as well as conflicts with architectural and structural walls, columns, ceilings and structural beams. All trades shall resolve conflicts at these meetings and sign off each sheetmetal shop drawing indicating acceptance and satisfactory resolution to all

conflicts. All conflicts that cannot be resolved shall be brought to the attention of the Engineer for resolution.

1.11 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping and ductwork is prohibited in electric and telephone rooms and closets, elevator machine rooms, and for installations over or within 5 ft of transformers, substations, switchboards, motor control centers, standby power plants, and motors.

B. Branch piping to equipment is acceptable when installed over or within 5 ft of motors.

1.12 DRIP PANS

A. Provide drip pans under piping when installation over or within 5 ft of electrical apparatus is unavoidable or in rooms containing electrical equipment. Pan shall be reinforced, properly supported and made watertight. Provide enclosed type for pressure piping. Extend 1-1/4 in. drain pipe from pan to spill over nearest floor drain or as indicated.

1. Construction shall be 32 oz sheet copper.

2. Construction shall be 18 gauge galvanized sheet steel.

1.13 PRODUCT, DELIVERY, HANDLING AND STORAGE

A. Ship materials and equipment in crated sections of sizes to permit passing through available space, where required.

B. Receive and accept materials and equipment at the site, properly handle, house, and protect them from damage and the weather until installation. Replace equipment damaged in the course of handling without additional charge.

C. Arrange for and provide storage space or area at the job site for all materials and equipment to be received and/or installed in this project.

1.14 TEMPORARY HEAT

A. Temporary heat will be provided under General Construction Work.

1.15 ACCESSIBILITY

A. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.

B. Group concealed valves, expansion joints, controls, dampers, and equipment requiring access, so as to be freely accessible through access doors.

1.16 SPECIAL TOOLS

A. Provide one set of any special tools required to operate, adjust, dismantle or repair equipment furnished under this Division for the Owner's use at the completion of the work.

B. Provide one pressure grease gun with adapters for each type of grease required.

C. Provide one suitable tool case for special tools.

1.17 CUTTING AND PATCHING

A. Provide all carpentry, cutting and patching required for proper installation of materials and equipment specified. Do not cut or drill structural members without review by Architect and Structural Engineer.

1.18 UTILITY CONNECTIONS

A. Arrange for and pay costs for all specified utilities including the following:

1. Connection to utility company mains.

2. Payment of service charges.

3. Provision for temporary utilities.

4. Connect in accordance with authority having jurisdiction.

1.19 PROTECTION OF MATERIALS

A. Protect from damage, water, dust, etc., materials, equipment and apparatus provided under this trade, both in storage and installed.

1.20 COORDINATED COMPOSITE DRAWINGS

A. The Contractor shall prepare full coordinated composite drawings for the mechanical, electrical, plumbing and fire protection trades. The Contractor shall overlay each trade's work (in separate colors) on a set of sheetmetal drawings. All conflicts and potential conflicts shall be clearly identified on the sheetmetal drawings. This shall include but not be limited to conflicts with lights, equipment, piping, ductwork and supports of other trades, as well as conflicts with architectural and structural walls, columns, ceilings and structural beams. All trades shall resolve conflicts and sign off each sheetmetal drawing indicating acceptance and satisfactory resolution to all conflicts. All conflicts that cannot be resolved shall be brought to the attention of the Architect and Engineer.

1.21 RECORD DRAWINGS

A. The contractor shall maintain a complete set of "Record Drawings" reflecting an accurate dimensional record of all work. These drawings shall be marked up to show the precise location of concealed work and equipment, including concealed piping and valves and all changes and deviations in the plumbing work from that shown on the contract drawings. This requirement shall not be construed as authorization for the contractor to make changes in the layout or work without written definite instruction from the Architect or Engineer.

B. Record dimensions shall clearly and accurately delineate the work as installed; location shall be suitably identified by at least two dimensions to permanent structures.

C. The contractor shall stamp all "Record Drawings" and certify for correctness by signing and dating them.

D. Record drawings submitted to Owner shall consist of 1 set mylars and 1 set compact CD's with all work provided on AutoCAD 2008 or higher format.

E. Prior to final acceptance, contractor shall submit certified "Record Drawings" to the Architect/Engineer for review and make changes, corrections or additions as noted by Architect/Engineer. After this review, the drawing shall be delivered to the Owner.

PART 2 – PRODUCTS

2.1 BASE BID MANUFACTURERS

A. Base bid on materials or equipment are specified by name of manufacturer, brand or trade name and catalog reference.

B. The choice will be optional with bidder where two or more manufacturers are named.

C. Manufacturers, other than specified, will only be considered if at the time of bid, manufacturers' names and proposed substitutions are named and stated and the difference in base bid is indicated including changes in the cost of all affected work. Detail equality and difference, item by item, for submission of manufacturers' equipment other than specified.

D. The following are base bid manufacturers for items under this Section:

1. Access doors: Karp Associates, Inc., Higgins Mfg. Co., Milcor Steel Co., and Walsh-Spencer Co.

2. Inserts: F and S Mfg Co., Fee and Mason and Grinnell.

3. Hangers and supports: I.T.T. Grinnell, Carpenter and Patterson, Inc., and Fee & Mason.

4. Paint: Sherwin-Williams, Pittsburgh Plate Glass Co., Pratt and Lambert, and Rust-Oleum.

5. Gratings: Irving Grating IKG Industries and Ryerson - Inland Steel Co.

2.2 INSERTS AND SUPPORTS

A. Support all HVAC work from building construction by providing inserts, beam clamps, steel fishplates (in concrete fill only), and acceptable brackets. Submit all methods for review.

B. Provide trapeze hangers of bolted angles or channels for grouped lines and services.

C. Provide additional framing where building construction is inadequate. Submit for review.

D. Inserts shall be steel, slotted type and factory-painted.

1. Single rod shall be similar to Grinnell Fig. 281.

2. Multi-rod shall be similar to Fee & Mason Series 9000 with end caps and closure strips.

3. Clip form nails flush with inserts.

4. Maximum loading including pipe, contents and covering shall not exceed 75 percent of rated insert capability.

E. Supports from steel decks:

1. Pipes:

a. Maximum size: 2-inch diameter.

b. Hanger spacing: maximum 10-feet centers.

2. Ductwork:

a. Hangers spacing: maximum 16-feet centers.

2.3 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS:

A. Furnish supplementary steel, channels and supports required for proper installation, mounting and support of HVAC work.

B. Connect supplementary steel and channels firmly to building construction in an acceptable manner.

C. Determine type and size of supporting channels and supplementary steel. Supplementary steel and channels shall be of sufficient strength and size to allow only a minimum deflection in conformance with manufacturer's requirements of loading.

D. Install supplementary steel and channels in a neat and workmanlike manner parallel to walls, floors, and ceiling construction.

E. All supplementary steel, channels, supports shall be submitted to Structural Engineer for review.

2.4 EXPANSION ANCHORS

A. Provide smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 Type 1, Class 3.

B. Do not exceed 1/4 of average valves for a specific anchor size using 2000 psig concrete only, for maximum working load.

C. Provide spacing and install anchors in accordance with manufacturer's recommendations.

2.5 ACCESS DOORS

A. Supply access doors for all concealed HVAC items in inaccessible walls and ceilings for complete access, using a minimum door size of 12 in. x 12 in. for installation under the General Construction Work. Locating and setting shall be performed after review.

B. Flush type access doors shall be similar to Karp Type DSC-211 with No. 13 USSG steel doors and trim and No. 16 USSG steel frame, metal wings for keying into construction, concealed hinges and screwdriver operated stainless steel cam lock. Provide lift off type access doors, similar to Karp Type DSC-212, where door cannot swing open.

C. In acoustic tile ceilings, factory finished white access doors shall be similar to Karp Type DSC-210, with No. 13 USSG steel frame, No. 16 USSG steel pan door suitable for receiving tile thickness and hinges that are not visible when door is closed. Access door shall have screwdriver operated stainless steel cam locks finishing flush with tile with a minimum of 2 per door.

D. In plaster ceilings recessed access doors shall be similar to Karp DSC-210-PL, with recess to receive plaster.

E. In fire rated construction provide fire rated access doors, similar to Karp KRP-150-FR, in accordance with applicable code requirements.

F. Access doors shall have one coat of shop-painted zinc chromate primer.

2.6 ACCESS TILE IDENTIFICATION:

A. In removable ceiling tiles, provide buttons, tabs, and markers to identify location of concealed work. Submit for review.

2.7 ACCESS PLATFORMS:

A. Provide access platforms for equipment, where indicated or required by authorities having jurisdiction, in accordance with OSHA regulations and indicate on shop drawings, details of construction and method of attachment.

B. Provide removable gratings, toe plates, and guard rails suitable for a minimum 100 pounds per sq ft floor loading.

C. Provide supports riveted or welded structural steel cross-braced on four sides and welded to baseplates for anchor bolting to concrete piers.

D. Gratings shall be similar to:

1. Steel: Irving "x-bar."

2. Aluminum: Irving "x-bar."

3. Fiberglass: Ryerson Duradek I-5000.

2.8 EQUIPMENT PLATFORMS

A. Provide equipment platforms, where indicated or required by authorities having jurisdiction, in accordance with OSHA regulations and as indicated. On shop drawings, show details of construction and method of attachment. Submit for review.

B. Equipment platform shall be supported from overhead construction. Platform shall be riveted or welded structural steel frame with intermediate framing and clip angles to receive suspension rods. Corners shall be reinforced with gusset plates. Baseplates shall be minimum 10 USSG steel plate riveted or welded to channel iron frame. Where overhead construction does not permit fastening of rods, provide additional steel members framed to span structural steel. Submit for review.

C. Equipment platform shall be supported from floor. Platform shall be riveted or welded structural steel frame with intermediate framing. Corners shall be reinforced with gusset plates. Baseplate shall be minimum 10 USSG steel plate riveted or welded to frame. Supports shall be riveted or welded structural steel, crossbraced on four (4) sides and welded to baseplate for anchor bolting to concrete piers. Submit for review.

D. Fasten vibration isolation bases as noted. Submit for review.

E. Submit shop drawings with details of construction and method of attachment.

2.9 LADDERS

A. Provide 18 in. wide properly supported, galvanized structural steel ladders designed in accordance with OSHA regulations with 2-1/2 in. x 2-1/2 in. side rails and 3/4 in. diameter rungs installed 12 in. on center.

2.10 SHAFT GRATINGS

A. Provide shaft gratings suitable for minimum of 100 pounds per sq ft floor loading.

B. Support on structural steel members and indicate on shop drawings, details of construction and method of attachment.

2.11 TRENCH COVERS AND FRAMES

A. Covers:

1. Provide 3 ft long, 1/4 in. thick galvanized checkered steel covers with flush drop-type lift handles and means for securing to frame for easy removal.

B. Provide 2 in. x 2 in. x 1/4 in. galvanized welded angle iron frame with welded stops and lugs for anchoring into concrete.

2.12 GUARD RAILINGS

A. Provide guards and railings as indicated and/or as required by OSHA and authorities having jurisdiction.

B. Provide removable type guards with clearances for motor adjustments, for belt driven and rotating equipment, with No. 18 USSG steel frames and No. 20 USSG galvanized perforated steel fronts with covered test openings to permit rpm readings without

removal. Provide galvanized steel angle or channel supports braced to maintain clearances of moving parts.

C. Provide removable type railings constructed of 1-1/4 in. pipe and rail fittings.

2.13 CHARTS

A. Provide valve tag chart indicating valve number, system, type, size, location and function for all valves. Refer to Specification Section 230553 for additional requirements.

B. Mount charts on walnut grained wood plaque, with clear plastic laminations covering diagrams.

C. Mount in aluminum frame and glass.

D. Letter and number valves and controls to correspond with designations on metal tags.

E. Fasten charts permanently in locations, as directed, with four brass screws.

F. Supplement numbering and lettering of charts of existing building.

2.14 NAMEPLATES

A. Provide nameplates with inscriptions, subject to review, indicating equipment and voltage. Fasten with epoxy cement or chrome plated screws. Nameplate shall be black Lamicoid sheet with white lettering.

B. Provide nameplates for gauges, meters, instruments, control devices, pilot lamps, transmitters, motor controllers and panel mounted equipment.

PART 3 - EXECUTION

3.1 COORDINATION

A. The Contractor shall assure full cooperation of all trades and shall furnish in writing all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Prepare coordinated composite drawings at a suitable scale not less than 1/4-inch equals one foot, zero inches, clearly showing how the work of this Division is to be installed in relation to the work of all trades. Any work installed in conflict with the work of other trades shall be corrected at no additional cost to the Owner.

C. The Contractor may, subject to the acceptance of the Architect and without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of all trades or for the proper execution of the work.

D. Mechanical Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Coordinate with the Architectural Drawings and details for exact location of ductwork, piping and equipment.

E. The Contractor shall follow Drawings in layout work and shall coordinate all trades to verify spaces in which work shall be installed. Maintain maximum headroom or space conditions. Where space conditions appear inadequate, the Architect shall be notified

before installation. Do not proceed with the installation until receiving clarifying instructions.

3.2 EXCAVATION AND BACKFILL

A. Excavate backfill and restore surfaces inside and outside building.

B. If rock is encountered, excavate to 6 in. below bottom of piping and refill with well tamped sand and gravel.

C. Bank excavated materials adjacent to trench and properly support with sheet piling and braces.

D. Install and maintain guards and keep excavation free of water with attended pumping equipment.

E. No extra compensation will be provided for quicksand, hardpan, or other material encountered in excavating, except rock on unit price basis.

F. Remove bog or other swampy conditions encountered in excavating to one ft below bottom of piping and backfill with well tamped sand, finely crushed stone, or gravel.

G. Immediately after piping is installed, inspected, tested and accepted, remove sheet piling with special care and solidly fill voids without damage to piping. Backfill in a manner to prevent future settlement. Use only good clean loam, clay, sand or gravel that is free from frozen materials, lumps of clay, rocks, boulders, cinders, slag ashes, vegetable or organic materials, or building or other debris, or refuse.

1. Hand fill in 4 in. layers up to 2 ft above pipe and remainder, fill in with 1 ft layers.

2. Tamp and puddle each layer before placing next layer.

3. Allow no stones larger than 2 in. diameter in fill up to 2 ft above piping and allow not stones larger than 4 in. diameter in fill over 2 ft above piping.

H. Restore surfaces, sidewalks, pavements, curbing, lawns, and shrubs that are disturbed or damaged.

I. Dispose of acceptable surplus excavation on site and remove surplus and unsuitable excavated materials from site as directed.

3.3 PAINTING

A. General:

1. Provide labor, materials, and equipment necessary for filed prime painting. Protect flooring and equipment with drop cloths and store paint and materials in a location where directed. Wire brush and remove all oil, dirt, rust and grease before applying paint.

2. Paint all exposed, uninsulated, non-galvanized sheet metal, other than stainless steel and aluminum, with two coats of aluminum paint or alkyd paint of a color as directed.

3. Paint all exposed, uninsulated, galvanized, aluminum and stainless steel sheet metal in finished spaces, including mechanical equipment rooms, with one coat of galvanized iron primers and two coats of alkyd oil paint.

4. Paint insulated piping and equipment covering with one coat of primer sealer and two coats of alkyd oil paint of a color as directed.

5. Factory or field apply one coat of heat resisting paint for steel pipe and finned tube radiation.

6. Paint exposed steel and metal work not furnished with factory-painted finish, structural steel piping support and uninsulated piping with two coats of alkyd oil paint of a color as directed.

7. Paint the following spaces under this contract:

   a. Mechanical Equipment rooms.

   b. Boiler rooms.

   c. Emergency Generator rooms.

8. Apply zinc chromate primer for black steel piping, cast iron piping (except underground), steel and iron work and steel tanks before insulation.

9. Dip in zinc chromate primer, uncoated hangers, supports, rods and inserts.

B. Coordinate color of painting to be provided under General Construction Work.

C. Supply and deliver, in original sealed containers, paint of the best grade for its purpose of colors, as selected, and apply in accordance with manufacturer's instructions.

D. Finish painting:

1. Provide finish painting for piping continuously painted in all exposed areas consisting of two finished coats of high gloss medium or long alkyd paint over prime coat of a color shade as accepted after submittal.

2. Utilize color as follows on Sherwin Williams, "Kem Lustral" or "Metalastic II" name and figure numbers.

   a. Chilled water piping and equipment --- PALE BLUE, F65L7.

   b. Condenser water piping --- PALE GREEN, F65G42.

   c. High pressure steam --- ORANGE, F65E1.

   d. Medium pressure steam --- FERRITE YELLOW, F65Y3.

   e. Low pressure steam --- LIGHT YELLOW, F65Y12.

f. Low pressure condensate --- IVORY, F65H1.

g. Hot water, pumped condensate and equipment --- MAGENTA (special mix) color similar to (B47R9) but in "Kem Lustral."

h. Chemical feed piping and equipment --- DARK BLUE, F65L4.

i. Refrigeration machines and refrigerant piping --- BRIGHT BLUE, F65L10.

j. Supply ductwork and fans --- SILVER GRAY, B53A10.

k. Control panels --- SLATE GRAY, B53A13.

l. Exhaust and return ductwork and fans --- STEEL GRAY, B53A11.

m. Fire detection and alarm conduit, fire stand pipe, sprinkler piping --- VERMILLION, F65R1.

n. Compressed air piping and equipment --- LIGHT GRAY, F65A2.

o. Vent and relief piping --- RICH BROWN, F65N11.

p. Boilers and breeching --- SLATE GRAY, B53A13.

q. Fuel and diesel oil --- BLACK, F65B1.

r. High temperature water --- ORANGE, F65E1.

s. Softened water, dealkalizers, softeners, brine tanks --- MEDIUM GREEN, F65G40.

t. City water --- LIGHT GREEN, F65G39.

3. Place unlisted piping, ductwork or equipment in one of the following classifications and color coded shades as accepted. This corresponds to colors of ANSI A13.1, (Scheme for identification of piping systems).

a. Red for fire-protection materials.

b. Yellow or Orange for dangerous materials.

c. Green or blue for safe materials.

d. Dark Blue or Purple for extra valuable materials.

e. Gray for general equipment.

4. Shades shall be consistent throughout the project.

5. Coat valve, strainer or other appurtenances operating at over 220 o F where bare metal is exposed with Silicone Alkyd Aluminum, 71S30.

E. Paint interior of ductwork as far back as visible from outside, flat black.

F. Apply factory prime coat for pumps, fans, motors, equipment, registers, diffusers, and grilles.

G. Apply on machinery, one shop coat of metal primer and two finish coats of gray engine enamel.

H. Apply on control valve handles, one coat of lead and oil paint of color as selected.

I. Paint fire dampers with prime coat and second coat of corrosion inhibitive paint.

J. Spot prime coat marred surface of prime coated equipment and piping to match adjacent coat.

3.4 PIPING IDENTIFICATION

A. Stenciling:

1. Mark piping every 10 ft with size, purpose, and direction of flow and clearly stencil letters and flow arrows with flat black paint, block type letters and white background.

a. Size of stencil as follows:

Outside Diam. of Pipe Covering	Size of Stencil
3/4 in. - 1-1/4 in.	1/2 in.
1-1/2 in. - 2 in.	3/4 in.
2-1/2 in. - 6 in.	1-1/4 in.
8 in. - 10 in.	2-1/2 in.
over 10 in.	3-1/2 in.

2. Indicate systems, size and direction of flow piping to be stenciled by Painting Contractor. Supervise stenciling and make stenciling readable from the floor of point from which ordinarily read.

3. Perform stenciling in accordance with the latest edition ANSI A13.1.

B. Pipe markers:

1. Provide factory fabricated, snap-on type pipe markers with service legend and flow arrows. The pipe markers shall be the weatherproof plastic type and shall not be used where surface temperature exceeds 180 degrees.

2. The pipe marker shall be similar to Seton Name Plate Corporation "Setmark," with the following types:

a. Smaller than 6 in.: Setmark SNA, completely encircling pipe.

b. 6 in. and larger: Setmark STR, stainless steel spring fasteners.

3. Adhesive type markers will not be permitted.

3.5 FOUNDATIONS

A. Foundations and concrete will be provided under General Construction Work.

B. Provide concrete as specified herein:

1. One part Portland cement, two parts fine aggregate, and four parts coarse aggregate.

2. Concrete shall be the same consistency as specified under General Construction Work.

3. Provide concrete, poured in place on roughened concrete floor, cleaned and slushed with coat of cement grout. Do not pour foundation unit concrete has set. Foundation shall be puddled and finished smooth.

C. Hold vibration isolation and anchor bolts in position during pour. Set anchor bolts in oversized sleeves with washers and nuts at bottom. Finish bolts shall be slush with nuts on top. Foundations shall extend 6 in. beyond equipment, except as noted.

D. Provide a minimum of 4 in. concrete foundations. Provide a minimum as required for installation of J bolts for foundations under built up air handling units.

E. Forms: Provide 18-gauge galvanized steel form with welded seams and joints, cross-strip bracing welded to top and bottom angle edges and intermediate bracing welded or riveted to sides as required. Bend top and bottom edges to form 2-inch integral internal angles (bend back exposed edges).

F. Forms: Provide moisture-resistant commercial standard fir with non-staining mineral oil interior surface coating with rounded or chamfered edges.

G. Forms: Forms will be provided under General Construction Work.

H. Provide foundations for:

1. Pumps.

2. Fans.

3. Air handling units and floor mounted plenums.

4. Refrigeration equipment.

5. Boilers.

6. Air compressors.

7. Floor mounted tanks.

8. Floor mounted control panels.

9. Motor controllers.

10. Motors.

11. Heat exchangers.

12. Converters.

13. As noted.

3.6 WATERPROOFING

A. Waterproofing will be provided under General Construction Work.

B. Where any work pierces waterproofing, installation shall be subject to review, provide all necessary sleeves, caulking, flashing and flashing fittings required to make openings absolutely watertight.

C. Flashing:

1. Provide 6 pounds lead.

2. Provide 16 ounces lead coated copper.

3. Provide No. 22 USSG aluminum.

4. Provide galvanized cast iron bottom roof type fittings, similar to Josam No. 26440 or No. 26450 for piping through roof.

3.7 FIELD QUALITY CONTROL

A. Perform tests as noted, and in the presence of Architect and/or Engineer and authorities having jurisdiction.

B. Provide required labor, material, equipment, and connections necessary for tests and submit results for review.

C. Repair or replace defective work and pay for restoring or replacing damaged work due to tests, as directed.

D. Tests and instruction: Refer to specification Section 230593.

3.8 CLEANING

A. Brush and clean work prior to concealing, painting and acceptance. Perform in stages if directed.

B. Clean and repair painted exposed work, soiled or damaged, to match adjoining work before final acceptance.

C. Remove debris from inside and outside of material and equipment.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed

from the work described in this specification section.

END OF SECTION 230001

SECTION 230005 - BASIC MECHANICAL MATERIALS AND METHODS

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. Mechanical 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 shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Where variances occur between the Drawings and the Specifications or within either document itself, the items or arrangement of better quality, greater quantity, or higher cost shall be

included in the contract price. The Contractor shall request clarification in writing from the Architect/Engineer on which item and manner in which the work shall be installed.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. 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.

D. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

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 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 minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig 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 minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

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: Plastic or 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 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, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Refer to "GENERAL PROVISIONS FOR HEATING, VENTILATION AND AIR CONDITIONING WORK" for general demolition requirements and procedures including selective demolition, cutting and patching.

B. Disconnect, demolish, and remove mechanical 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 and/or by Owner/Engineer.

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 annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

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 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.

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. 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 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 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 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 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, 28-day compressive-strength concrete and reinforcement as identified on drawing details.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to "GENERAL PROVISIONS FOR HEATING, VENTILATION AND AIR CONDITIONING WORK" for supplemental structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical 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 mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 230005

SECTION 230529 - HANGERS AND SUPPORTS

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 the following hangers and supports for mechanical system piping and equipment:

1. Metal framing systems.
2. Fiberglass strut systems.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Related Sections include the following:

1. Division 23 Section "Vibration Isolation & Seismic Restraints for HVAC, Fire Protection & Plumbing Components."
2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.
5. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Metal framing systems. Include Product Data for components.
2. Fiberglass strut systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 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.

2.2 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 FIBERGLASS STRUT SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Champion Fiberglass, Inc.
3. Cope, T. J., Inc.; Tyco International Ltd.
4. Seasafe, Inc.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.

f. Powers Fasteners.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, 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 APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

D. 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.

E. 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.

F. 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 absorb 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 absorb 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 absorb 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.

G. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

H. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

I. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

J. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

B. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

C. 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.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. 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.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. 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.

I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 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 contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 230529

SECTION 230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Stencils.
8. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.

c. Labels of tested compliances.

2. Location: Accessible and visible.

3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.

2. Data:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.

2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.

3. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.

4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.

2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.

4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, outside air and exhaust). Include contact-type, permanent adhesive.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Metal or fiberboard.

2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station, zone-type units and water source heat pumps.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Meters, gages, thermometers, and similar units.
    c. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    d. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    e. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    f. Fans, blowers, primary balancing dampers, and mixing boxes.
    g. Packaged HVAC central-station, zone-type units and water source heat pumps.
    h. Tanks and pressure vessels.
    i. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
   a. Light Blue: For cooling equipment and components.
   b. Yellow: For heating equipment and components.
   c. Green and Yellow: For combination cooling and heating equipment and components.
   d. Brown: For energy-reclamation equipment and components.
2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   e. Fans, blowers, primary balancing dampers, and mixing boxes.
   f. Packaged HVAC central-station, zone-type units and water source heat pumps.
   g. Tanks and pressure vessels.
   h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

F. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For supply ducts.
2. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
4. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.7 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:
   a. Constant-volume air systems.
2. HVAC equipment quantitative-performance settings.
3. Space pressurization testing and adjusting.
4. Vibration measuring.
5. Sound level measuring.
6. Indoor-air quality measuring.
7. Verifying that automatic control devices are functioning properly.
8. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

P. TAB: Testing, adjusting, and balancing.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of systems or equipment.

S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. The Contract Documents examination report.
c. TAB plan.
d. Work schedule and Project-site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

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.

1. Contract Documents are defined in the General Conditions of Contract.

2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described other Divisions.

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 equipment performance data including fan and pump curves. 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. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
5. Sensors are located to sense only the intended conditions.
6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at indicated values.
8. Interlocked systems are operating.
9. Changeover from heating to cooling mode occurs according to indicated values.

S. Report deficiencies discovered before and during performance of TAB procedures to Architect/Engineer. 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 system readiness 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 according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing "and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, 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 outside-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. Check for proper sealing of air duct system.

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 fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable 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 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.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. 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 modes 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 static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

   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. 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 terminal 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 terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using 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.

E. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
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.

F. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.6 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.7 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.8 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.

C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.

1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
3. Test room pressurization first, then zones, and finish with building pressurization.

D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.

E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.

1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.

F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.

G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.9 PROCEDURES FOR VIBRATION MEASUREMENTS

A. Use a vibration meter meeting the following criteria:

1. Solid-state circuitry with a piezoelectric accelerometer.
2. Velocity range of 0.1 to 10 inches per second.
3. Displacement range of 1 to 100 mils.
4. Frequency range of at least 0 to 1000 Hz.
5. Capable of filtering unwanted frequencies.

B. Calibrate the vibration meter before each day of testing.

1. Use a calibrator provided with the vibration meter.
2. Follow vibration meter and calibrator manufacturer's calibration procedures.

C. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.

1. Turn off equipment in the building that might interfere with testing.
2. Clear the space of people.

D. Perform vibration measurements after air and water balancing and equipment testing is complete.

E. Clean equipment surfaces in contact with the vibration transducer.

F. Position the vibration transducer according to manufacturer's written instructions and to avoid interference with the operation of the equipment being tested.

G. Measure and record vibration on rotating equipment over 3 hp.

H. Measure and record equipment vibration, bearing vibration, equipment base vibration, and building structure vibration. Record velocity and displacement readings in the horizontal, vertical, and axial planes.

1. Fans and HVAC Equipment with Fans:

a. Fan Bearing: Drive end and opposite end.
b. Motor Bearing: Drive end and opposite end.
c. Equipment Casing: Top and side.
d. Equipment Base: Top and side.
e. Building: Floor.
f. Ductwork: To and from equipment after flexible connections.
g. Piping: To and from equipment after flexible connections.

2. Chillers and HVAC Equipment with Compressors:

a. Compressor Bearing: Drive end and opposite end.
b. Motor Bearing: Drive end and opposite end.
c. Equipment Casing: Top and side.
d. Equipment Base: Top and side.
e. Building: Floor.
f. Piping: To and from equipment after flexible connections.

I. For equipment with vibration isolation, take floor measurements with the vibration isolation blocked solid to the floor and with the vibration isolation floating. Calculate and report the differences.

J. Inspect, measure, and record vibration isolation.

1. Verify that vibration isolation is installed in the required locations.
2. Verify that installation is level and plumb.
3. Verify that isolators are properly anchored.
4. For spring isolators, measure the compressed spring height, the spring OD, and the travel-to-solid distance.

5. Measure the operating clearance between each inertia base and the floor or concrete base below. Verify that there is unobstructed clearance between the bottom of the inertia base and the floor.

3.10 PROCEDURES FOR SOUND-LEVEL MEASUREMENTS

A. Perform sound-pressure-level measurements with an octave-band analyzer complying with ANSI S1.4 for Type 1 sound-level meters and ANSI S1.11 for octave-band filters. Comply with requirements in ANSI S1.13, unless otherwise indicated.

B. Calibrate sound meters before each day of testing. Use a calibrator provided with the sound meter complying with ANSI S1.40 and that has NIST certification.

C. Use a microphone that is suitable for the type of sound levels measured. For areas where air velocities exceed 100 fpm, use a windscreen on the microphone.

D. Perform sound-level testing after air and water balancing and equipment testing are complete.

E. Close windows and doors to the space.

F. Perform measurements when the space is not occupied and when the occupant noise level from other spaces in the building and outside are at a minimum.

G. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.

H. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, and other large surface capable of altering the measurements.

I. Take sound measurements in dBA and in each of the 8 unweighted octave bands in the frequency range of 63 to 8000 Hz.

J. Take sound measurements with the HVAC systems off to establish the background sound levels and take sound measurements with the HVAC systems operating.

1. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.

K. Perform sound testing at two locations on Project for each of the following space types. For each space type tested, select a measurement location that has the greatest sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.

1. Apartments.
2. Each space with a noise criterion of RC or NC 25 or lower.
3. Each space with an indicated noise criterion of RC or NC 35 and lower that is adjacent to a mechanical equipment room or roof mounted equipment.
4. Inside each mechanical equipment room.

3.11 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS

A. After air balancing is complete and with HVAC systems operating at indicated conditions, perform indoor-air quality testing.

B. Observe and record the following conditions for each HVAC system:

1. The distance between the outside-air intake and the closest exhaust fan discharge, cooling tower, flue termination, or vent termination.
2. Specified filters are installed. Check for leakage around filters.
3. Cooling coil drain pans have a positive slope to drain.
4. Cooling coil condensate drain trap maintains an air seal.
5. Evidence of water damage.
6. Insulation in contact with the supply, return, and outside air is dry and clean.

C. Measure and record indoor conditions served by each HVAC system. Make measurements at multiple locations served by the system if required to satisfy the following:

1. Most remote area.
2. One location per floor.
3. One location for every 5000 sq. ft.

D. Measure and record the following indoor conditions for each location two times at two-hour intervals, and in accordance with ASHRAE 113:

1. Temperature.
2. Relative humidity.
3. Air velocity.
4. Concentration of carbon dioxide (ppm).
5. Concentration of carbon monoxide (ppm).
6. Nitrogen oxides (ppm).
7. Formaldehyde (ppm).

3.12 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.13 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.14 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.15 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: As Work progresses, prepare 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.

3.16 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. 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, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
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 firm 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, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, 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 or VFD settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.

a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
g. Number of belts, make, and size.

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 airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.

h. Other system operating conditions that affect performance.

E. 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 outside, 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.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:

a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat coil static-pressure differential in inches wg.
g. Cooling coil static-pressure differential in inches wg.
h. Heating coil static-pressure differential in inches wg.
i. Outside airflow in cfm.
j. Return airflow in cfm.

k. Outside-air damper position.
l. Return-air damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-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.

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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):

a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.
e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.

dd. Condenser fan motor amperage for each phase.

L. Vibration Measurement Reports:

1. Date and time of test.
2. Vibration meter manufacturer, model number, and serial number.
3. Equipment designation, location, equipment, speed, motor speed, and motor horsepower.
4. Diagram of equipment showing the vibration measurement locations.
5. Measurement readings for each measurement location.
6. Calculate isolator efficiency using measurements taken.
7. Description of predominant vibration source.

M. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:

1. Date and time of test. Record each tested location on its own NC curve.
2. Sound meter manufacturer, model number, and serial number.
3. Space location within the building including floor level and room number.
4. Diagram or color photograph of the space showing the measurement location.
5. Time weighting of measurements, either fast or slow.
6. Description of the measured sound: steady, transient, or tonal.
7. Description of predominant sound source.

N. Indoor-Air Quality Measurement Reports for Each HVAC System:

1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.
6. Observed deficiencies.

O. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.17 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. Randomly 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. Measure sound levels at two locations.
    e. Measure space pressure of at least 10 percent of locations.
    f. Verify that balancing devices are marked with final balance position.
    g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence 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 Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner/ Architect.
3. Owner/Architect shall randomly select measurements documented in the final report to be rechecked. The 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 the 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.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing 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 testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230719 - PIPE INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 23 Section "Duct Insulation" for insulation for ducts and plenums.
2. Division 23 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
2. Attachment and covering of heat trace inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties and equipment connections.
6. Application of field-applied jackets.

C. 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.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification 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."

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of steam or electric heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of Division 01 Specifications, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. Knauf FiberGlass GmbH.

b. Substitutions: Not permitted.

2. Flexible Elastomeric Thermal Insulation:

a. Armstrong World Industries, Inc.

b. Substitutions: Not permitted.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, 0.22 Btu-in/hr-ft²-°F minimum k with factory-applied, all-purpose, vapor-retarder jacket.

2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.

3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.

b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.

5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.

6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials, 0.22 Btu-in/hr-ft²-°F minimum k.

1. Adhesive: As recommended by insulation material manufacturer.

2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.

2. PVC Jacket Color: White or gray.

D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.

2. Adhesive: As recommended by insulation material manufacturer.

E. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

1. Finish and Thickness: Smooth finish, 0.010 inch thick.

2. Moisture Barrier: 1-mil-thick, heat-bonded polyethylene and kraft paper.

3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

F. Stainless-Steel Jacket: ASTM A 666, Type 304 or 316; 0.10 inch thick; and roll stock ready for shop or field cutting and forming to indicated sizes.

1. Moisture Barrier: 1-mil-thick, heat-bonded polyethylene and kraft paper.

2. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket.

3. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd.

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch) thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.

C. Wire: 0.080-inch nickel-copper alloy; 0.062-inch soft-annealed, stainless steel; or 0.062-inch soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply 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. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Floor, Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

T. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.

3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.

3. Apply insulation to flanges as specified for flange insulation application.

4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.

2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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 the same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.

2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.

3. Apply insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply 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 jacket manufacturer's recommended adhesive.

3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets 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-retarder mastic.

C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket in exposed locations as specified in other sections.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the 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.

3.8 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Below-grade piping, unless otherwise indicated.
4. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.9 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Condensate drain piping.

1. Operating Temperature: 35 to 75 deg F.

2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: 1".
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Refrigerant suction and hot-gas piping.
1. Operating Temperature: 35 to 50 deg F.
2. Insulation Material: Flexible Elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:
a. Steel or Copper Pipe, Up to 4" diameter: 1" INSULATION THICKNESS
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: None.

3.11 EXTERIOR INSULATION APPLICATION SCHEDULE

A. This application schedule is for aboveground insulation outside the building.

B. Service: Refrigerant suction.
1. Operating Temperature: 35 to 50 deg F.
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:
a. Steel or Copper Pipe, Up to 4" diameter: 2" INSULATION THICKNESS
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

END OF SECTION 230719

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling, and condenser water systems; makeup water for these systems; blowdown drain lines; and condensate drain piping.

B. Related Sections include the following:

1. Division 23 Section "Basic Mechanical Materials and Methods" and "General Provisions for HVAC Work" for general piping materials and installation requirements.
2. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
3. Division 23 Section "Mechanical Identification" for labeling and identifying hydronic piping.

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride.

B. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals.

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.6 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Div. 23 "General Provisions for HVAC Work" and on drawing details.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with code requirements of firestopping for fire and smoke wall and floor assemblies.

1.7 EXTRA MATERIALS

A. Water Treatment Chemicals: Furnish sufficient chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of Division 01 Specifications, provide products by one of the following:

1. Grooved Mechanical-Joint Fittings and Couplings:
   a. Victaulic Company of America.
   b. Substitutions: Not permitted.

2. Pre-insulated piping and fittings (for underground installation):
   a. Perma-Pipe, Inc.
   b. Substitutions: Not permitted.

3. Pressure-Reducing Valves:
   a. ITT Bell & Gossett; ITT Fluid Technology Corp.
   b. Substitutions: Not permitted.

4. Safety Valves:

a. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.

b. Substitutions: Not permitted.

5. Expansion Tanks:

a. ITT Bell & Gossett; ITT Fluid Technology Corp.

b. Substitutions: Not permitted.

6. Air Separators and Air Purgers:

a. ITT Bell & Gossett; ITT Fluid Technology Corp.

b. Substitutions: Not permitted.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

E. Wrought-Copper Unions: ASME B16.22.

F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.

C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.

D. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

H. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.

3. Facings: Raised face.

I. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.

J. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

K. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

L. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

M. Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.

N. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

O. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

P. sleeve and sealed with a heat shrink sleeve to prevent the ingression of moisture or debris.)

2.5 PLASTIC PIPE AND FITTINGS

A. CPVC Plastic Pipe: ASTM F 441, Schedules 40 and 80, plain ends.

B. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends.

C. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.

1. CPVC Solvent Cement: ASTM F 493.

D. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

1. PVC Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints or Schedule 40 PVC pipe with solvent-welded joints may be used in mechanical spaces.

B. Condensate Drain Lines in Return Air Plenum Ceilings: Type L drawn-temper copper tubing with soldered joints or Schedule 40 CPVC pipe with solvent-welded joints may be used in mechanical spaces.

3.2 PIPING INSTALLATIONS

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" and "General Provisions for HVAC Work" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

G. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

H. Anchor piping for proper direction of expansion and contraction.

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.4 PIPE JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC and CPVC piping.

3.5 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at end of mains, at heat-transfer coils, as indicated on drawings and details and elsewhere as required for system air venting.

B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, where indicated and on drawings and details and elsewhere as required for system air venting.

C. Install dip-tube fittings in boiler outlet. Install piping to expansion tank with a 2 percent upward slope toward tank. Connect boiler-outlet piping.

D. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2 and larger.

E. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

F. Install expansion tanks on floor unless indicated otherwise. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install ports for pressure and temperature gages at coil inlet connections.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.8 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

3.9 CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 232113

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

B. Related Sections include the following:

1. Division23 Section "Hangers and Supports" for pipe supports and installation requirements.

2. Division 23 Section "Mechanical Identification" for labeling and identifying refrigerant piping.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."

B. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

D. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.5 COORDINATION

A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements of firestopping for materials and methods for sealing pipe penetrations through fire and smoke barriers.

E. Coordinate pipe fitting pressure classes with products specified in related Sections.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Refrigeration Oil Test Kits: Two each, containing everything required to conduct one test.

2. Refrigerant: Two containers each, with 20 lb of refrigerant.

3. Filter-Dryer Cartridges: Three of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of Division 01 Specifications, provide products by one of the following:

1. Refrigerants:

a. DuPont Company; Fluorochemicals Div.

b. Substitutions: Not permitted.

2. Refrigerant Valves and Specialties:

a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.

b. Substitutions: Not permitted.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR or ASTM B 88, Type L.

B. Annealed-Temper Copper Tube: ASTM B 280, Type ACR or ASTM B 88, Type L.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

F. Flexible Connectors: 500-psig minimum operating pressure; seamless tin-bronze core, high-tensile bronze-braid covering, and solder-joint end connections; dehydrated, pressure tested, minimum 7 inches long

2.3 VALVES

A. Diaphragm Packless Valves: 500-psig working pressure and 275 deg F working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

B. Packed-Angle Valves: 500-psig working pressure and 275 deg F working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

C. Check Valves Smaller Than NPS 1: 400-psig operating pressure and 285 deg F operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

D. Check Valves, NPS 1 and Larger: 400-psig operating pressure and 285 deg F operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained polytetrafluoroethylene seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.

E. Service Valves: 500-psig pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

F. Solenoid Valves: Comply with ARI 760; 250 deg F temperature rating and 400-psig working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosure of type required by location, with 1/2-inch conduit adapter and 24 -V, normally closed holding coil.

G. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.

H. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

I. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

J. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

2.4 REFRIGERANT PIPING SPECIALITIES

A. Straight- or Angle-Type Strainers: 500-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

B. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 deg F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

C. Replaceable-Core Filter-Dryers: 500-psig maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate

with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:

1. Filter Cartridge: Pleated media with integral end rings, stainless-steel support, ARI 730 rated for capacity.
2. Filter-Dryer Cartridge: Pleated media with solid-core sieve with activated alumina, ARI 730 rated for capacity.
3. Wax Removal Cartridge: Molded, bonded core of activated charcoal and desiccant with integral gaskets.

D. Permanent Filter-Dryer: 350-psig maximum operating pressure and 225 deg F maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

E. Mufflers: 500-psig operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

2.5 RECEIVERS

A. Receivers, 6-Inch Diameter and Smaller: ARI 495, UL listed, steel, brazed, 400-psig pressure rating, with tappings for inlet, outlet, and pressure relief valve.

B. Receivers Larger Than 6-Inch Diameter: ARI 495, welded steel, tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII; 400-psig pressure rating, with tappings for liquid inlet and outlet valves, pressure relief valve, and liquid-level indicator.

2.6 REFRIGERANTS

A. ASHRAE 34, R-134a.

B. ASHRAE 34, R410A.

C. ASHRAE 34, R407C.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground, within Building: Type ACR drawn-copper tubing.

B. Belowground for NPS 2 and Smaller: Type L annealed-copper tubing.

3.2 VALVE APPLICATIONS

A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.

B. Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

C. Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.

D. Install diaphragm packless or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

E. Install a full-sized, three-valve bypass around each dryer.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve.

1. Install solenoid valves in horizontal lines with coil at top.

2. Electrical wiring for solenoid valves is specified in Division 26 Sections. Coordinate electrical requirements and connections.

G. Install thermostatic expansion valves as close as possible to evaporator.

1. If refrigerant distributors are used, install them directly on expansion-valve outlet.
2. Install valve so diaphragm case is warmer than bulb.
3. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
4. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

3.3 SPECIALTY APPLICATIONS

A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

B. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

C. Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

D. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

E. Install pressure relief valves on ASME receivers; pipe discharge to outdoors.

F. Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.

G. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

H. Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

I. Install receivers, sized to accommodate pump-down charge, on systems 5 tons and larger and on systems with long piping runs.

J. Install flexible connectors at or near compressors.

3.4 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Belowground, install copper tubing in protective conduit. Vent conduit outdoors.

G. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

H. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. Install bypass around moisture-liquid indicators in lines larger than NPS 2.

J. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.

K. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

L. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports."

M. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe rollers for multiple horizontal runs 20 feet or longer, supported by a trapeze.
4. Spring hangers to support vertical runs.

N. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
7. NPS 2-1/2): Maximum span, 10 feet; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

O. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

A. Braze joints according to Division 23 Section "Basic Mechanical Materials and Methods."

B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.6 FIELD QUALITY CONTROL

A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.

2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.

a. System shall maintain test pressure at the manifold gage throughout duration of test.

b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.

c. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.

2. Check compressor oil level above center of sight glass.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves, except bypass valves that are used for other purposes.

5. Check compressor-motor alignment, and lubricate motors and bearings.

3.8 CLEANING

A. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

B. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

3.9 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter-dryer after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round, spiral-seam ducts and formed fittings.
3. Duct liner.

B. Related Sections include the following:

1. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. NUSIG: National Uniform Seismic Installation Guidelines.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Shop Drawings: After coordination with trades, prepare CAD-generated drawings at minimum 3/8 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Reflected ceiling plans, room names and numbers.
4. Major building and structural elements.
5. Major equipment and piping for Mechanical Rooms.
6. Elevations of top and bottom of ducts.
7. Dimensions of main duct runs from building grid lines.

8. Elevation views, locating dimensions from column lines or other references.
9. Duct acoustical lining or external insulation.
10. Fittings.
11. Reinforcement and spacing.
12. Seam and joint construction.
13. Penetrations through fire-rated and other partitions.
14. Equipment installation based on equipment being used on Project.
15. Duct accessories, including access doors and duct-mounted equipment such as fire, smoke, automatic control and balancing dampers, sound attenuators, humidifiers, airflow measuring stations, airflow control valves, smoke detectors and fans.
16. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
17. Interferences between ductwork and piping, lights or structure.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.

D. Field quality-control test reports.

E. Leak test procedures, including test pressures, ductwork system definition and method for approving a total system.

F. Submit for record:

1. Leak Test Field Reports (refer to Part 3 of this section)

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and "Sheet Metal Welding Code," for duct joint and seam welding].

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

C. All ductwork shall be free from pulsation, chatter and vibration. If any of these defects appear after a system is in operation, correct by removing and replacing, or reinforcing the ductwork at no additional cost to the Owner.

D. Close the open ends of ducts during construction to prevent dirt and debris from entering.

E. Touch-up all welded and scratched galvanized steel surfaces with zinc-rich paint.

F. Duct leakage testing shall be performed and documented by a RESNET certified rater using approved protocols.

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. Manufacturers: Subject to compliance with requirements of Division 01 Specifications, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

a. CertainTeed Corp.; Insulation Group.

b. Substitutions: Not permitted.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

a. Thickness: 1 inch.

b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.

c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb-tensile, dead-load test perpendicular to duct wall.

2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.4 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

1. All duct sealants shall comply with SCAQMD Rule 1168 table under "other" and shall have a VOC level limit of 420 g/l (less water) or less.

2. Duct adhesives, such as tapes, shall comply with SCAQMD Rule 1168 table and shall have a VOC level limit of 30 g/l (less water) or less.

B. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.

C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Substitutions: Not permitted.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Substitutions: Not permitted.

2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.

3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

I. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Longitudinal- and Spiral Lock Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
    a. Manufacturers:
        1) Ductmate Industries, Inc.
        2) Substitutions: Not permitted.

D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

F. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
   a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
   b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
   a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
   b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with double-thickness turning vanes.
5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
10. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg.
2. Supply Ducts (in Mechanical Equipment Rooms): 2-inch wg.
3. Return Ducts (Negative Pressure): 1-inch wg .
4. Exhaust Ducts (Negative Pressure): 1-inch wg.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in other sections.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints with mastic sealants according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated and to meet leakage requirements.

1. For pressure classes lower than 2-inch wg, seal transverse joints.
2. Clean metal surfaces with cleaning agent as recommended by duct sealing system manufacturer.
3. Apply duct sealing components in accordance with manufacturer's written instructions.

B. Seal ducts before external insulation is applied.

3.4 SPECIAL HANDLING OF DUCTWORK

A. Fabricate, handle and transport all supply, exhaust, and return ductwork with special concern for internal and external cleanliness. Wipe clean the inside and outside of all ductwork and fittings of grease, dust and other debris before delivery to the jobsite, and wrap ends in 4 mil thick polyethylene plastic for shipment and storage at the jobsite. During installation, secure all open ends with 4 mil thick polyethylene plastic prior to joining of duct sections. As each section is joined, vacuum and reseal the inside. If dirt is found inside the ductwork during installation, each section shall be removed from the system and properly cleaned prior to reinstallation. Follow similar procedures for all HVAC air equipment with openings such as but not limited to fans, furnaces, air handling units, coils, etc.

3.5 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. An owner's representative shall perform field tests and inspections, using RESNET approved testing protocols, and prepare test reports. Duct systems shall be installed to meet the criteria listed below.

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct leakage tests, on all ductwork, at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Ductwork leakage shall not exceed 6 cubic feet per minute per 100 square feet of conditioned space.
4. Remake leaking joints, apply additional sealant as required and retest until leakage is equal to or less than maximum allowable. All tests must be witnessed and results verified by the Owner's Representative. Submit field test report certifying that the ductwork does not exceed the maximum allowable leakage.

3.8 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.
1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
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.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Duct silencers.
8. Turning vanes.
9. Duct-mounting access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Ceiling fire dampers.
6. Smoke dampers.
7. Combination fire and smoke dampers.
8. Duct silencers.
9. Turning vanes.
10. Duct-mounting access doors.
11. Flexible connectors.
12. Flexible ducts.

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. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

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. Manufacturers: Subject to compliance with requirements of Division 01 Specifications, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: 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: 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.

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Ruskin Company.

2. Substitutions: Not permitted.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch- thick, galvanized sheet steel with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Neoprene.

F. Blade Axles: Nonferrous.

G. Tie Bars and Brackets: Aluminum or Galvanized steel.

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. Ruskin Company.

2. Substitutions: Not permitted.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.

2. Roll-Formed Steel Blades: 0.064-inch-thick, galvanized sheet steel.

3. Blade Axles: Plated steel.

4. Bearings: Stainless-steel sleeve.

5. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Stainless steel.
4. Bearings: Molded synthetic thrust or ball.
5. Blade Seals: Neoprene.
6. Jamb Seals: Cambered stainless steel.
7. Tie Bars and Brackets: Galvanized steel.

E. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: 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. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Ruskin Company.
2. Substitutions: Not permitted.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch-, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch-thick, galvanized-steel damper blades with maximum blade width of 8 inches.

1. Secure blades to 1/2-inch-diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Provide closed-cell neoprene edging, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in. x lbf when tested according to AMCA 500D.

2.6 FIRE DAMPERS

A. Manufacturers:

1. Ruskin Company.
2. Substitutions: Not permitted.

B. General Description: Fire dampers shall be dynamic, Type B for rectangular duct, Type C for round duct, meeting UL Standard 555. Rate the dampers to close at 4 inches water pressure differential at 2375 feet per minute

C. Fire dampers shall be labeled according to UL 555.

D. Fire Rating: 1-1/2 hour

E. The frames shall match the fire rating of adjacent construction and shall have a pressure drop of 0.04 inch water at 2000 fpm.

F. Frame: 20 gage galvanized steel channel.

G. Blades: Roll-formed, interlocking, 24 gage galvanized steel curtain type out of air stream.

H. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Damper sleeve shall be of thickness as follows for connection to adjoining ductwork with rigid connections in accordance with UL 555, subject to a maximum thickness of 0.135 inch for uncoated steel and 0.138 inch for coated steel unless a larger sleeve thickness is tested.

a. For damper not exceeding either 36 inches wide or 24 inches high, minimum 0.053 inch thick for uncoated steel and 0.056 inch thick for coated steel except where a greater thickness is required by the specified SMACNA construction standards.

b. For damper larger than either 36 inches wide or 24 inches high, minimum thickness of 0.067 inch thick for uncoated steel and 0.070 inch thick for coated steel except where a greater thickness is required by the specified SMACNA construction standards.

2. Where Contractor elects to have the damper sleeve furnished by the damper manufacturer, it shall be the full responsibility of the Contractor to inform the damper manufacturer where the adjoining ductwork will be thicker than the minimum herein before specified, and to verify that such a thicker sleeve is furnished by the damper manufacturer.

3. Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

I. Mounting Orientation: Vertical or horizontal as indicated.

J. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

K. Fusible Links: Replaceable, 165 deg F rated.

2.7 SMOKE DAMPERS

A. Manufacturers:

1. Ruskin Company.

2. Substitutions: Not permitted.

B. General Description: Smoke dampers shall be two position, opposed-blade or parallel-blade type dampers, designed and tested in accordance with AMCA 500. Labeled according to UL 555S and shall meet the Class II leakage requirements of UL Standard 555S. Obtain and verify the location, size and pressure rating of each damper assembly prior to fabrication and delivery. Damper shut-off pressure rating shall exceed the fan maximum total head-pressure.

C. Frame: 5 inch minimum by 1 inch formed channel, Type 6063T5 extruded aluminum with a nominal wall thickness of 0.125 inch. Finish shall be mill.

D. Blades: Airfoil-shaped; Type 6063T5 extruded aluminum with a nominal wall thickness of 0.081 inch. Maximum blade width shall be 6 inches.

E. Seals: Blade edge shall be extruded vinyl or silicone rubber; jamb seals shall be aluminum, flexible metal compression type.

F. Bearings: Stainless steel or bronze sleeve type, pressed or bolted into frame.

G. Operation Temperature Range: Minus 50 to plus 250 degrees F.

H. Smoke dampers shall utilize linkages concealed in the frame such that no blade linkages or connecting rods are located in the airstream.

I. The smoke damper supplier shall coordinate, with the smoke damper installer, the locations and sizes of each smoke damper such that the maximum velocity rating of each smoke damper is not exceeded. Smoke damper assemblies consisting of multiple sections shall be sized (maximum blade width) to meet the maximum duct velocity in which the individual smoke damper assembly is to be installed, and under no circumstances shall the maximum individual smoke damper blade width be greater than 36 inches. Smoke dampers shall be capable of withstanding up to 6000 fpm with a 12-inch damper width.

J. Damper Motors: Modulating and two-position action.

1. Provide with electric actuators sized to provide sufficient torque to limit leakage to the specified rate.

K. Combination Fire/Smoke Damper: Where a combination fire/smoke damper is used, damper construction shall also comply with the requirements for Fire Dampers specified in the preceding article.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch-wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Substitutions: Not permitted.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Substitutions: Not permitted.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.

b. Up to 18 Inches Square: Two hinges and two sash locks.

c. Up to 24 by 48 Inches Three hinges and two compression latches with outside and inside handles.

d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:

a. Ductmate Industries, Inc.

b. Substitutions: Not permitted.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.

2. Substitutions: Not permitted.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

E. 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. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg F.

F. 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.

2.11 FLEXIBLE DUCTS

A. Manufacturers:

1. Flexmaster U.S.A., Inc.

2. Substitutions: Not permitted.

B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized 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.

C. Flexible Duct Clamps: Stainless steel clamps with a hexhead cadmium-plated screw-driven worm gear.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Installer shall examine conditions under which equipment is to be installed and notify Architect/Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and the Architect/Engineer.

3.2 APPLICATION AND 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. Provide 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 on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct silencers independent of ducts with flexible duct connectors, lagged with loaded vinyl sheet on inlets and outlets.

I. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers, turning vanes, and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum spacing.
5. On sides of ducts where adequate clearance is available.

J. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body Plus Ladder Access: 25 by 17 inches.

K. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

L. Label access doors according to Division 23 Section "Mechanical Identification."

M. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

N. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

P. Support flexible ducts with minimum 2-inch wide straps or hangers, spaced so that horizontal runs do not sag more than 3/4-inch per foot of horizontal distance between supports.

Q. Install duct test holes where indicated and required for testing and balancing purposes.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

3.4 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.
6. Correct any unsatisfactory conditions.

END OF SECTION 233300

SECTION 233423 - POWER VENTILATORS

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 the following:

1. Axial roof ventilators.

2. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual 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 gages and finishes, including color charts.

5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed 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: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustical tile.
3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Maintenance Data: For power ventilators to include in 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 other Divisions.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

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: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceiling-Mounted Ventilators:

a. Ammerman Company, Inc./General Resource Corp.

b. Breidert Air Products, Inc.

c. Broan Mfg. Co., Inc.

d. Carnes Company HVAC.

e. Cook, Loren Company.

f. Dayton Electric Manufacturing Co.

g. FloAire, Inc.

h. Greenheck Fan Corp.

i. JennFan; Div. of Breidert Air Products, Inc.

j. NuTone Inc.

k. PennBarry, Inc.

l. Twin City Fan and Blower Company.

2.2 CEILING-MOUNTED 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: Plastic, 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. Ceiling Radiation Damper (where required by wall and/or ceiling ratings): Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.

2. Filter: Washable aluminum to fit between fan and grille.

3. Isolation: Rubber-in-shear vibration isolators.

4. Manufacturer's standard roof jack or wall cap, and transition fittings.

5. Provide controllers as specified elsewhere and where indicated on drawing schedules.

2.3 MOTORS

A. Comply with requirements in Division 23 Section "Motors."

B. Enclosure Type: Guarded drip proof.

2.4 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. Support units using spring isolators (restrained where indicated) having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in other Division 23 Sections.

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by code. Concrete, reinforcement, and formwork requirements are specified in other Division 23 Sections and on drawing details.

D. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.

E. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

F. Support suspended units from structure using threaded steel rods and spring hangers. Vibration-control devices are specified in other Division 23 Sections.

1. In seismic zones, restrain support units.

G. Install units with clearances for service and maintenance.

H. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

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 "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. 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. Equipment Startup Checks:

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. Verify lubrication for bearings and other moving parts.

6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.

2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

2. Review data in maintenance manuals.

3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

PART 4 – PAYMENT

4.1 Payment

A. No payment shall be made for this item as part of this specification section. Payment for work included in this specification section shall be included in the various bid items constructed from the work described in this specification section.

END OF SECTION 233423

SECTION 238126 – SPLIT SYSTEM AIR CONDITIONING UNITS

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 split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

B. Related Sections include the following:

1. Division 15 Section "Vibration Isolation and Seismic Restraints" for isolation pads, spring isolators, and seismic restraints.

1.3 DEFINITIONS

A. Evaporator-Fan Unit: The part of the split-system air-conditioning unit that contains a coil for cooling (heat rejection for heating operation in heat pump units) and a fan to circulate air to conditioned space.

B. Compressor-Condenser Unit: The part of the split-system air-conditioning unit that contains a refrigerant compressor and a coil for condensing refrigerant (evaporator for heating operation in heat pump units).

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units of sections of units showing the full range of colors available for units with factory-applied color finishes.

D. Maintenance Data: For split-system air-conditioning units to be included in maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered.

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.

1.6 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in other Division 15 Sections and on drawing details.

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations.

1.7 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 split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

C. Warranty Period: Five years from date of substantial completion.

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. Filters: Two set of each disposable filter type for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Daikin AC

2. Mitsubishi Electronics America, Inc.; HVAC Division.

2.2 WALL- OR CEILING-MOUNTED, HEAT PUMP EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan and Motor: Centrifugal fan, directly driven by multispeed, electric motor with integral overload protection; resiliently mounted.

D. Filters: Permanent, cleanable.

E. Units must be similar to the Mitsubishi PEFY indoor unit model. Unit must also be EnergyStar compliant.

2.3 AIR-COOLED (HEAT PUMP), INVERTER COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Heat pump with inverter technology to allow simultaneous heating and cooling to satisfy demands of each indoor unit (zone) connected.

C. Inverter Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Scroll.

2. Compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

D. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

E. Heat Pump Components (where applicable): Reversing valve and low-temperature air cut-off thermostat.

F. Fan: Aluminum-propeller type, directly connected to motor.

G. Motor: Permanently lubricated, with integral thermal-overload protection and DC inverter.

H. Low Ambient Kit: Permits operation down to 0 deg F.

I. Units must be similar to the Mitsubishi PUMY outdoor unit model. Unit must also be EnergyStar compliant.

2.4 ACCESSORIES

A. Controls: Functioning to remotely control compressor and evaporator fan, with the following features:

1. 2 stage cooling with dehumidification cycle.

2. Compressor time delay.

3. 24-hour time control of system and zones to stop and start.

4. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed for each zone.

5. Fan-speed selection, including auto setting.

6. Tie system into existing building control system.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in other Division 15 Sections and on drawing details. Coordinate anchor installation with concrete base.

D. Install roof-mounted compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 15 Section "Vibration Isolation and Seismic Restraints."

F. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

D. 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. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 COMMISSIONING

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that units are installed and connected according to the Contract Documents.

C. Lubricate bearings, adjust belt tension, and change filters.

D. Perform startup checks according to manufacturer's written instructions and do the following:

1. Fill out manufacturer's checklists.

2. Check for unobstructed airflow over coils.

3. Check operation of condenser capacity-control device.

4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 238126

SECTION 260000 - GENERAL REQUIREMENTS FOR DIVISION 26 WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide under this Division of the Specification a complete electrical system, fully adjusted, tested, and commissioned for use as indicated on the Drawings and as specified herein.

B. Work Specified in This Division:

260001 General Requirements for Division 26 Work
260002 Basic Electrical Materials and Methods
260458 Vibration Isolation and Seismic Restraints for Electrical Systems
260519 Wires and Cables
260526 Grounding and Bonding
260533 Raceways
260534 Junction and Pull Boxes
260535 Outlet Boxes
260543 Service Equipment
262415 Distribution Panelboards
262726 Wiring Devices
262813 Fuses
262816 Safety Disconnect Switches
265000 Lighting and Accessories

C. The Contractor shall examine all other Divisions of the Specification to determine the full extent of related work required to be performed under this Division. Failure to do so will not relieve the Contractor of responsibility to perform all work required for a complete and satisfactory installation.

1.3 CODES AND STANDARDS

A. Codes and Standards listed below, insofar as they apply, form a part of these Specifications, the same as if they were fully written and shall be followed as minimum requirements. Where standards conflict, that standard with the more stringent requirements shall be applicable. This shall not be construed as relieving the Contractor from providing the highest grade of material and workmanship specified.

B. The Contractor shall give written notice to the Architect of any materials or apparatus believed in violation of laws, ordinances, rules or regulations, or Authorities Having Jurisdiction.

C. All equipment shall comply with all applicable requirements of laws, codes, ordinances,

legislation, etc., of all Federal, State, and Local Authorities, whether or not indicated on the Contract Documents.

D. The referenced codes shall include any and all supplements, addenda, memoranda, information bulletins and any other changes and additions effective prior to the Date of Substantial Completion by adoption of the local Authority Having Jurisdiction.

E. Modifications required by the Authorities Having Jurisdiction shall be made without additional charge to the Owner.

F. Where alterations to and/or deviations from the Contract Documents are required by the Authorities, report the requirements to the Architect and secure his approval before starting the alterations.

G. Where Contract Documents' requirements are in excess of Code requirements and are permitted under the Code, the Contract Documents shall govern.

H. All rules and regulations of the Underwriters Laboratories shall be complied with whether or not indicated in the Contract Documents. Provide Division 26 equipment having UL labels or labeled by an independent testing agency acceptable to the Authority Having Jurisdiction.

I. All work shall comply with the following codes and standards (as adopted locally):

1. Codes:

International Building Code, 2015 Edition

International Energy Conservation Code, 2015 Edition

National Electrical Code, 2014 edition.

2. Standards:

National Fire Protection Association (NFPA).

ANSI/ICC A117.1 Accessible and Usable Buildings and Facilities, 2009 Edition

Underwriters Laboratories, Inc. (UL).

American National Standards Institute (ANSI).

National Electrical Manufacturers Association (NEMA).

1.4 PERMITS

A. The Contractor shall be responsible for obtaining and paying for all permits, licenses, and inspection certificates required for all work in accordance with the provisions of the Contract Documents.

1.5 DEFINITIONS

A. "Provide": to supply, install and make complete, safe, and operable, the particular work referred to unless specifically indicated otherwise.

B. "Install": to erect, mount and make complete with all related accessories.

C. "Furnish" or "supply": to purchase, procure, acquire, and deliver complete with related accessories.

D. "Work": includes labor, materials, equipment, services, and all related accessories necessary for the proper and complete installation of complete systems.

E. "Wiring": includes raceway, fittings, wire, boxes, and all related accessories.

F. "Concealed": not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceilings, trenches, crawl spaces, or enclosures.

G. "Exposed": in view, not installed underground or "concealed" as defined above.

H. "Indicated," "shown," or "noted": as indicated, shown or noted on drawings or specifications.

I. "Similar" or "equal": of base bid manufacturer, equal in quality, materials, weight, size, performance, design and efficiency of specified product, conforming with "Base Bid Manufacturers."

J. "Reviewed," "satisfactory," "accepted," or "directed": as reviewed, satisfactory, accepted, or directed by or to Architect and/or Engineer.

1.6 GUARANTEE

A. The Contractor will guarantee in form satisfactory to the Owner, that all Work installed will be free from any and all defects in workmanship and materials for a period of one year, to include one full heating and one full cooling season, from the date of certification of substantial completion or acceptance by the Owner, whichever is later. Guarantee that all apparatus will develop capacities and characteristics specified.

B. During the guarantee period the Contractor shall remedy defective workmanship, materials, and apparatus performance, without cost to the Owner, within a reasonable time to be specified by the Owner. In default thereof, the Owner may have such work done and charge all costs to the Contractor in accordance with the General conditions of the Contract and Division 1.

C. Provide product warranties as specified in the various Sections of this Division. Minimum product warranty shall be one year.

1.7 COMPLETE PERFORMANCE OF WORK

A. Work shall be executed in strict accordance with the best practice of the trades in a thorough, substantial, workmanlike manner by competent workmen.

B. Provide labor, materials, apparatus, and appliances essential to the complete functioning

of the systems described and indicated or which may be reasonably implied as essential whether mentioned in the Contract Documents or not.

C. In cases of doubt as to the Work intended, or in the event of need for explanation thereof, the Contractor shall request supplementary instructions from the Architect.

D. Provide skilled journeymen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper installation of the Work of this Division.

1.8 COOPERATION WITH OTHER TRADES

A. Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Architect and Owner) any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Where the work of various trades will be installed in close proximity to one another, or where there is evidence that the work of one trade will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. Prior to the execution, procurement or fabrication of any work, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4-inch = 1-foot 0-inch clearly showing work of all trades. If the Contractor allows one trade to install his work before coordinating with work of other trades, the Contractor shall make necessary changes to correct the condition without extra charge.

1.9 DRAWINGS

A. The Drawings show the general layout of the various items of equipment. However, layout of equipment, accessories, specialties, conduit, etc. are diagrammatic unless specifically dimensioned, and do not necessarily indicate every required fitting, junction box, pull box, relay or similar items required for a complete installation. Consult the Architectural Drawings and details for exact location of fixtures and equipment. Where same is not definitely located, obtain the information from the Architect before proceeding.

B. The Contractor shall follow the Drawings in laying out the work and check drawings of all trades to verify spaces in which work will be installed. Maintain maximum headroom and where space conditions appear inadequate, the Architect shall be notified before proceeding with the installation.

C. Any apparatus, appliance, material or work not shown on the Drawings but mentioned in the Specifications, or vice versa, shall be provided by the Contractor without additional expense to the Owner.

D. Where variances occur between the Drawings and the Specifications, or within either document itself, the items or arrangement of better quality, greater quantity, or higher cost shall be included in the contract price. The Contractor shall request clarification in writing from the Architect on which item and manner in which the work shall be installed.

1.10 SURVEYS AND MEASUREMENTS

A. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site, and check the corrections of same as related to the Work and submittals.

B. Should the Contractor discover any discrepancy between actual measurements and those indicated which would prevent following intent of the Drawings and Specifications, he shall notify the Architect and shall not proceed until he has received interpretations from the Architect.

1.11 EQUIPMENT FURNISHED BY OTHERS

A. When so specified or shown, the Contractor shall install any equipment furnished by others.

B. The Contractor shall receive at the site, unload, uncrate, store, protect, set in place, and connect up completely any such equipment or fixtures which require electrical service connections. All such connections shall be in accordance with the Manufacturer's recommendations and these Specifications.

C. The Contractor shall consult Manufacturer's literature and inspect the actual piece of equipment or fixture to determine roughing in dimensions and locations for all services.

D. The Contractor shall exercise special care in handling and protecting such equipment and fixtures and shall be responsible for the cost of replacing any such equipment or fixtures which are missing; and for the cost of repairing any damage to each piece of equipment and fixtures or finished work, caused by mishandling or failure to protect on the part of the Contractor.

1.12 CONFERENCE PRIOR TO START OF WORK

A. Immediately upon the award of this Contract, but prior to commencing any Work, the Contractor together with designated major subcontractors shall confer with the Architect and Engineer concerning the Work under this Contract.

B. The conference will be held at a mutually agreed place and acceptable time.

1.13 PROTECTION

A. The Contractor shall maintain protection of the Work and materials during construction from theft, injury or damage.

B. The Contractor shall carefully store all material and equipment received on site which are not immediately installed.

C. The Contractor shall provide temporary covers on enclosures as required during construction to prevent damage.

D. The Contractor shall be responsible for all work and equipment on project until inspected, tested and accepted by the Owner.

E. Any equipment damaged shall be refinished back to original condition.

1.14 MANUFACTURER'S RECOMMENDATIONS

A. With exceptions as specified or indicated in the Contract Documents, apply, install, connect, erect, use, clean, and condition manufactured articles, materials, and equipment per manufacturer's current printed recommendations. Keep copies of such printed recommendations at job site.

1.15 SPACE LIMITATIONS

A. Equipment has been chosen which will fit into the physical spaces provided and indicated, and allow for access, servicing, removal and replacement of parts, etc. The Contractor shall provide adequate space for clearance in accordance with the Code requirements and the requirements of the local Authorities Having Jurisdiction for all equipment, including "future equipment" to be installed at a later date.

B. In the preparation of Contract Documents, a reasonable effort to accommodate specified Equipment Manufacturers' space requirements has been made. However, since space requirements and equipment arrangement vary according to each manufacturer, the responsibility for access and proper fit rests with the Contractor.

C. Physical dimensions and arrangements of equipment to be installed shall be subject to the Architect's review.

D. The Contractor shall be responsible for confirming the sufficiency of the size of shafts and chases, the adequate thickness of partitions and adequate clearance in double partitions and hung ceilings for the proper installation of his work. Such spaces and clearances shall be kept to the minimum size required.

1.16 SUBMITTALS

A. After the Contract is awarded, but prior to proceeding with the Work, the Contractor shall obtain complete submittals from the manufacturers, suppliers, vendors, subcontractors, sub-subcontractors, for all materials and equipment specified in this Division and submit data and details of such materials and equipment to the Architect and Engineer.

B. Prior to forwarding submittals to the Architect and Engineer, the Contractor shall review and stamp all submittals to indicate that the equipment, materials, methods, etc. represented by the submittals are in compliance with the Contract Documents prior to submission.

C. The Contractor shall check all materials and equipment after their arrival on the job site and verify their compliance with approved submittal and the Contract Documents.

D. A period of two weeks, exclusive of transmittal time, will be required in the Engineer's

office each time a submittal is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling his work.

E. Submittal Types:

1. Product data submittal: Manufacturers' literature or sample which the Contractor intends to provide for the Project. Product data submittals will be reviewed for compliance with the information shown and the design concept expressed in the Contract Documents. Approval of a specific item does not constitute approval of an assembly of which the item is a component. Submit equipment operating data, general arrangement, materials of construction, etc.
2. Quality control submittal: Shop drawing of an assembly of components with construction dimensions and details as appropriate. The Contractor is responsible for construction means, methods, techniques, sequences and procedures and for the accuracy of dimensions, quantities, substantiating instructions for installations of equipment and systems.
3. Contract closeout submittals: Information required at substantial completion of the Project. Contract closeout submittals will be reviewed for conformance with the specified content.

F. Approval of product data shall not relieve the Contractor of the responsibility for errors that may be contained therein, or for deviations from requirements in the Contract Documents. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the product data the Contract Documents shall govern the work and are neither waived nor superseded in any way by submittal review.

G. For each submittal, the Contractor shall provide a cover sheet on his business letterhead which consist of:

1. Whether or not item being submitted is the "Basis of Design", "Alternate Specified Item" or "Substitute Item" as indicated in the Contract Documents. In the event that the item or equipment being submitted is not the "Basis of Design", Contractor shall state that they have reviewed the Contract Documents and will provide any modifications or revisions to the Contract required to properly install the equipment. This shall be accomplished at no additional cost to the Owner, in compliance with Section 260001-2.2 "Materials."

H. Provide submittals with the following:

1. Cover sheet with submittal title, submittal number, name of Project, names of Architect, Engineer, Contractor, Subcontractor, manufacturer, supplier/vendor, the submittal date, the dates of any revisions, and the applicable spec section and paragraph numbers.
2. Clear identification of each manufacturer.
3. Irrelevant catalog information deleted.

I. Provide submittals in the following quantities.

1. Product data submittals: as specified in Division 1.
2. Quality control submittals: two copies; one for the Architect's file and one for the Engineer's file. Provide two (2) additional copies for the Owner.
3. Contract closeout submittals: minimum of two copies or as specified in the various sections; both approved copies will be turned over to the Owner.

J. The Contractor shall maintain one complete, up-to-date set of all reviewed submittals and all quality control submittals at the project site. Within 90 days of the conclusion of the project, this submittal file shall be turned over to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as may be described in PART 1 and PART 3 of this Section, refer to PART 2 of the various Sections of Specification Division 26, ELECTRICAL.

2.2 MATERIALS

A. The word "Provide" is defined as requiring the Contractor to "furnish, erect, and install complete and commission for use" the item to which it refers.

B. All materials and apparatus required for the work except as specified otherwise, shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged to fit properly into the building spaces. Where no specific kind or quality of material is given, a first class standard article as approved by the Architect shall be provided.

C. Where any specific material, process or method of construction, or manufactured article is specified by name or by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance as specified or noted on the Drawings. In all cases, the Contractor shall verify the duty specified with the specific characteristics of the equipment offered for approval.

D. Materials, equipment, etc., used in the Work shall not contain asbestos or PCB's in any form or composition.

E. Equipment designated as "Basis of Design" has been coordinated for structural penetrations; duct, piping, and electrical connection; operating and service (maintenance) requirements; and physical size with regard to space where equipment is housed. Other specified manufacturers of like equipment are acceptable contingent on the Contractor providing a complete installation and maintaining full responsibility to provide, at no additional cost, any modifications to the structure or configuration of adjoining equipment and the installation that is required to properly install, operate, and service the equipment being used.

F. The Contractor shall provide equipment, materials, etc. from the specified manufacturers. Where no alternate manufacturers are specified the exact make specified shall be provided. The Architect shall have the right to reject any alternative submitted

and to insist on the specified material.

G. All component parts of each item of equipment or device shall bear the manufacturers nameplate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate maintenance or replacement. The nameplate of a Subcontractor or Distributor will not be acceptable.

H. Unless otherwise specifically indicated in the Drawings or Specifications, all equipment and materials shall be applied with the approval of the Architect in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

2.3 SHORT-CIRCUIT AND PROTECTION COORDINATION STUDY

A. The Contractor shall submit for acceptance as a product data submittal type brochure as prepared by equipment supplier only, each of which shall include complete short-circuit and protection coordination studies with coordination plots for each switchboard, distribution, and branch panelboard. The studies shall include the medium voltage power distribution system and relay characteristics, the base quantities selected, impedance source data, calculation methods and tabulations, one-line diagrams, impedance diagrams, conclusions, and recommendations. Short-circuit momentary duties, when applicable, and interrupting duties shall be calculated on the basis of an assumed fault at each switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the systems. The short-circuit tabulations shall include the fault impedances, X to R ratios, asymmetry factors, KVA, symmetrical, and asymmetrical fault currents.

B. The shop drawing brochure coordination plots required shall graphically indicate the coordination proposed for the several systems centered on full scale log-line diagrams and legends, associated medium voltage power distribution relay or system characteristics, motor controller fuses and relays, significant motor starting characteristics, complete operating bands for switchboard circuit breaker trip devices, fuses, if applicable, and the associated system load protective devices, etc. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, and time dial setting required. The long-time region of the coordination plots shall indicate a complete tap scale for each medium-voltage relay, full-load current and 150, 400 or 600 percent full-load current transformer parameter, and designate the pickups required for the low-voltage circuit breakers. The short-time region shall indicate the medium-voltage relay instantaneous elements, the magnetizing inrush, and ANSI withstand transformer parameters, the low-voltage circuit breaker, short-time and instantaneous trip devices, fuse manufacturing tolerance bands, including the low-voltage network protector fuses, when applicable, significant symmetrical and asymmetrical fault currents, etc. Each primary protective device required for a delta-to-wye-connected transformer shall be selected so the characteristic or operating band is within the transformer parameters, which shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults. The transformer damage curve shall be included for each transformer when the selected protective device is not within the associated parameters. Low-voltage power circuit breakers shall be separated from each other and the associated primary protective device by a 16 percent current margin for line-to-line faults. Medium-voltage relays

shall be separated by a 0.4 second time margin when the maximum three-phase fault flows, to assure proper selectivity. The protective device characteristics or operating bands shall be suitably terminated to reflect the actual symmetrical and asymmetrical fault currents sensed by the device.

C. The shop drawing brochures may be prepared with a network analyzer or a digital computer, but shall include complete fault calculations as hereinbefore specified for each proposed and ultimate source combination. It should be noted that source combinations may include proposed and future power company feeders, large motors, or generators. Brochures based on written calculations shall include sample calculations for each voltage category. The shop drawing brochures shall be prepared by the power circuit breaker or equipment manufacturer who furnished the switchgear or equipment for the incoming service to the site.

D. The Contractor shall note that the Drawings and Specifications indicate the general requirements for the motors, motor-starting equipment, low-voltage equipment, etc., but additional specific characteristics of equipment furnished shall be determined in accordance with the results of the short-circuit and protection coordination study. The equipment design discrepancies and the proposed corrective modifications as required shall be submitted with the short-circuit, available fault current calculation and protection coordination study with any variations clearly noted on the subsequent shop drawings. Necessary field settings, adjustments, and changing fuse type or circuit breaker ratings for conformance with the approved short-circuit and protection coordination study shall be accomplished by the particular manufacturer or by the Contractor without additional expense to the Owner.

E. Contractor may reduce short circuit ratings of equipment listed as basis of design if the study allows and with architect approval.

2.4 SUBMITTALS

A. The following equipment shall be by the same manufacturer. Submit this equipment together in a covered binder with each item separated by a tabbed section.

1. Safety switches
2. Switchboards
3. Distribution panelboards
4. Combination starters/disconnects

B. Provide short circuit study and equipment installation drawing with these submittals. In the absence of the short circuit study, the above product data submittals will not be reviewed.

PART 3 - EXECUTION

3.1 COORDINATION

A. The Contractor shall assure full cooperation of all trades and shall furnish in writing all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Where necessary, prepare composite working drawings at a suitable scale not less than 1/4-inch equals one foot, zero inches, clearly showing how the work of this Division is to be installed in relation to the work of all trades. Any work installed in conflict with the work of other trades shall be corrected at no additional cost to the Owner.

C. The Contractor may, subject to the acceptance of the Architect and without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of all trades or for the proper execution of the work.

D. Electrical Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Coordinate with the Architectural Drawings and details for exact location of fixtures and equipment.

E. The Contractor shall follow Drawings in layout work and shall coordinate all trades to verify spaces in which work shall be installed. Maintain maximum headroom or space conditions. Where space conditions appear inadequate, the Architect shall be notified before installation. Do not proceed with the installation until receiving clarifying instructions.

3.2 SLEEVES, PLATES, AND INSERTS

A. The sleeves, plates, and inserts shall be carefully located in advance of the construction of walls, slabs, and decks.

B. Sleeves shall be provided for all conduit passing through metal decks or concrete slabs. Sleeves shall be provided for all conduit passing through masonry, concrete, tile, and gypsum wallboard construction.

C. Sleeves in concrete floor slabs may be Schedule 40 P.V.C. pipe.

D. Fasten sleeves securely in slabs, decks, and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other material from being forced into the space between conduit and sleeves during construction.

E. Where sleeves are placed through slabs, decks, or fire-rated wall construction and following placing of electrical service therein, resulting opening and unused sleeves shall be filled with factory built devices or with manufactured fill, void, or cavity materials "Classified" by Underwriters' Laboratories, Inc. for use as a Through-Penetration Firestop. All firestop devices and systems shall be approved for such use by the authority having jurisdiction. The fire safing system used shall maintain the fire resistance rating of the building component that is penetrated. Fire safing systems and devices shall comply with ASTM E 814 (UL 1479). Submittal data for fire safing systems shall include the U.L. System Numbers listed in the U.S. Building Materials Directory under which the material was tested in accordance with ASTM E 814 (UL 1479) for use in a Through-Penetration Firestop System. Excessive shrinkage of the fire stopping materials which would permit the transmission of smoke or water prior to exposure to a fire condition is unacceptable. Where a mastic coating is used to seal the surface of the firestop, the mastic shall be non-hardening. The fire safety system used shall accommodate expansion and contraction without damaging the firestop or reducing

its effectiveness as a smoke barrier or water seal. Approved firestop sealing component/systems are as follows:

1. Tremco Fire-Resistive Joint System using Dymeric sealant and Cerablanket-FS mineral filler.
2. Dow Corning 306548 Silicone RTV Foam.
3. 3M Fire Barrier Penetration Sealing Systems (Electro Products Divisions).
4. GEG Pensil 1851 Silicone RTM Foam by General Electric.
5. T&B Flame-Safe Fire Retardant Products.

F. Sleeves penetrating walls below grade shall be standard weight black steel pipe with 1/4 inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be four inches wider all around than the sleeve it encircles. The entire assembly shall be hot dipped galvanized after fabrication. Seal off annular opening between conduit and sleeve with "Link Seal" casing seal as manufactured by Thunderline Corporation, Wayne Michigan. The pipe sleeve shall be sized to accommodate the Thunderline casing seal. Casing seals shall be Series 300 for conduit size 3/4 inches through 4 inches and Series 400 for conduit sizes 5 inches and longer.

G. Check floor and wall construction finishes to determine proper length of sleeves for various locations and make actual lengths to suit the following.

1. Terminate sleeves flush with walls, partitions, and ceilings. Sheet metal thimbles of adequate strength to resist deformation by construction materials may be used in non-structural walls and ceilings.
2. In areas where conduits are concealed, as in chases, formed penetrations may be used.
3. In area where conduits are exposed, extend sleeves 2 inches above finished floor.

H. Sleeves through beams or within 30 inches of column center lines shall be ASTM A-500 or A-501 steel pipe. All other sleeves shall be Schedule 40, ASTM A-120 galvanized or black steel pipe where required by structural engineer or where required to extend above the floor.

3.3 EXCAVATING AND BACKFILLING

A. Excavation as required to acceptably install work covered in this Division of the Specifications shall be provided as a portion of the work of this Division.

B. It shall be the responsibility of the Contractor to check the indicated elevations of the utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, the Architect shall be notified of such conditions before excavations are commenced.

C. Contractor shall be responsible for backfilling areas indicated but not used by utility companies.

D. Excavation and backfill shall be as specified in the Earthwork section of the Architectural Specifications.

3.4 ACCESSIBILITY

A. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to motors, controllers, switchgear, junction boxes, etc. If required for better accessibility, furnish access door for this purpose. Minor deviations from Drawings may be made to allow for better accessibility, but any change must be noted and approved by the Architect before proceeding with the work.

B. It shall be the responsibility of the trade installing any concealed equipment needing access to provide access panels for each item requiring service. Access panels shall be coordinated with the material in which it shall be installed. Access panels are specified in the Architectural section.

C. Access panels shall be provided where shown on the Drawings and otherwise where required for service of equipment. All required locations for access panels not shown on Drawings shall be submitted by the Contractor to the Architect for review. No access panels shall be installed until its location is reviewed and accepted by the Architect. The Contractor shall make reasonable modifications to his work in order to provide acceptable access panel locations.

D. Wherever access is required through walls or ceilings to motors, controllers, pull boxes, or other concealed equipment installed under this Division, the Contractor shall provide a hinged access door and frame as follows:

1. Drywall construction - Milcor Style AT, or as approved by Architect, with drywall insert and casing beads.
2. Finished acoustical tile ceiling - Milcor Style AT, or as approved by Architect.
3. Finished plaster ceiling - Milcor Style AP, or as approved by Architect.
4. Finished plaster walls or ceramic tile - similar to doors required for finished acoustical tile ceiling.
5. Access doors shall be "B" label fire construction where required.

3.5 EQUIPMENT NOISE AND VIBRATION

A. It is the intention to specify and for the Contractor to provide equipment and systems that, as defined herein, shall be quiet and free of apparent vibration in operation.

B. It is intended that vibration shall not be apparent to the senses in occupied areas of the building. To this end, both the balancing of rotating machinery and the installation of vibration isolation at various locations are required.

C. It shall be the responsibility of the Contractor to obtain equipment that is quiet in operation as compared to other available equipment of this size, capacity, and type; to install equipment so that a minimum amount of noise and/or vibration is transmitted to the building.

D. Any additional precautions deemed necessary to provide a quiet installation shall be done as part of the work of the Contractor, subject to review by the Engineer and without additional cost to the Owner. After the system is in operation, it shall be the

responsibility of the Contractor to make any changes to equipment or work installed that may be required to provide a system which is quiet in operation as defined herein.

E. The system noise level shall be equal to or less than NC40.

3.6 LUBRICATION

A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a lubrication tube with suitable fitting to an accessible location and suitably identify it.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer, until the Owner issues a certificate of substantial completion for the equipment, item or system.

3.7 ELECTRICAL CONNECTIONS

A. General:

1. The Contractor shall familiarize himself with all sections of these Specifications in order to provide necessary electrical connections to all equipment. Such equipment shall be connected, complete, and ready for operation in accordance with manufacturer's recommendations. Where such connections are made using a receptacle and cap, the necessary pigtail shall be provided.
2. Safety disconnect switches shall be provided for all motors or equipment as required by the N.E.C. whether shown on the Drawings or not.
3. Temperature control wiring in general shall be installed under the section specifying the equipment, unless specifically indicated on the Electrical Drawings. Under this section, power shall be provided where indicated to serve such systems as indicated.
4. Individual temperature control devices, such as thermostats which directly control unit heaters, float switches, etc., shall be supplied and connected under the section specifying the equipment.
5. The electrical subcontractor shall provide all wiring, with the exception of the following.

    a. Equipment control wiring, except for smoke control.
    b. Interlock wiring.

6. Provide all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. Install all starters not factory mounted on equipment.
7. All control, signal, interlock, and equipment control wiring, regardless of voltage, shall be installed in raceway system unless specifically indicated or specified otherwise.
8. Provide all fire alarm system and smoke control wiring, regardless of voltage. Install in separate raceway systems as specifically specified in the fire alarm system section.
9. Provide all power connections for heat-taped equipment and piping and extend

proper connections to locations coordinated with supplier.

3.8 FIELD OBSERVATIONS

A. Work identified as requiring corrective action by the Contractor is considered not to be in compliance with the Contract Documents.

1. The Contractor shall provide prompt written notice to the Architect outlining what remedial measures are to be taken to correct each noted deficiency and the date the corrective action will be available for re-examination.
2. The Contractor is responsible for scheduling remedial work in a timely fashion so that the corrected work may be re-examined. Uncovering work for the purpose of checking corrective actions will be at the cost of the Contractor regardless of the acceptability of the remedial work.
3. The Contractor shall provide the Architect a minimum of five regular working days notice, exclusive of transmittal time, of the date corrective action is available for re-examination.

3.9 OPERATING INSTRUCTIONS

A. The Contractor shall provide the services of a factory trained specialist to supervise the start-up of all equipment specified in this Division and to instruct the Owner's operators for 2 - 8-hour day(s) operating instruction period. The operating instruction period shall cover all major Division 26 equipment and all Division 26 systems and be defined as straight time working hours and shall not include nights, weekends, or travel time to and/or from the project. See individual Sections for additional instructions required of Manufacturer's trained specialists.

B. All instruction periods shall be video taped by the Contractor in VHS format. Upon completion of all instruction periods, Contractor shall deliver record video tapes to the Owner.

C. The Owner shall be notified in writing at least five days before each operating instruction period begins. The Contractor shall commence no instruction period until the Owner has issued his written acceptance of the starting time.

D. At the conclusion of the operating instruction period(s) the Contractor shall submit to the Owner a separate certification letter signed by each instructor identifying the system and/or equipment covered in the instruction period, the duration, and that the equipment was in proper operating condition at the time of the instructions. The Owner or his authorized representative shall counter-sign these certifications attesting to the completeness of the instruction period and shall forward copies of the counter-signed certificate to the Architect for his files.

3.10 OPERATING AND MAINTENANCE MANUALS

A. The Contractor shall provide operating instructions and maintenance data manuals for each specific item of equipment and materials provided under this Division.

B. Submit operating and maintenance data manuals for review at least four weeks before

systems' start-up. Assemble all data in a completely indexed three-ring binder(s).

C. Maintenance manuals shall include the minimum following information. Refer to individual sections of this Division for specific additional requirements.

1. Identifying name and Contract Document designation.
2. Equipment section shall include corrected copies of all product data submittals manufacturer operations, parts manuals and written maintenance instructions for each individual piece of equipment.
3. Local source for parts and service.
4. Locations (where several similar items are used, provide a list).
5. Complete nameplate data.
6. Complete lubrication, cleaning, and servicing data.
7. Parts lists with diagrams.
8. Wiring diagrams.
9. Troubleshooting guides.
10. Manufacturer's recommended operating and maintenance instructions with all non-applicable information deleted.
11. Panel schedules (8 1/2 x 11 copies)

3.11 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate as-built record of all Work. In addition, the "Record Drawings" shall be marked to show the precise location of hidden-from-view work and equipment, including, but not limited to, concealed or embedded raceways, junction boxes, pull-boxes, and all changes and deviations in the Work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect.

1. The "Record Drawings" shall consist of a complete set of the Contractor's quality control submittals.

2. The Contractor shall utilize the Division 26 Contract Drawings as the basis for Record Drawings of that portion of the Work where no submittals were required, (i.e., equipment schedules, schematics, etc.). All references to member firms of the design team shall be blacked-out on Contract Drawings used for Record Drawings.

3. The Contractor is responsible for all reproduction costs associated with Record Drawings.

4. Drawings shall show all conduit paths (1-1/2" and larger unless specified otherwise) with installation details included and all raceways labeled as to use.

5. All work outside the limits of the building shall show exact location and depth below grade of all raceways, duct banks and direct buried cables.

B. Record dimensions shall clearly and accurately delineate all Division 26 base building

and tenant Work provided; locations shall be suitably identified by at least two dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS. To be used for recording Field Deviations and Dimensional Data Only."

D. Upon completion of work, the Contractor shall certify the "Record Drawings" for correctness by providing and signing the following certification:

"CERTIFIED CORRECT

(Name of Contractor)

By:

Date:

(Name of Electrical Subcontractor)

By:

Date:_____"

E. Prior to testing of the Work of this Division, the Contractor shall forward properly certified reproducible "Record Drawings" to the Architect as a quality control submittal in accordance with the requirements of paragraph 1.15 of this Section.

3.12 START-UP

A. At a time designated by the Owner, all Work provided by Division 26 shall be operated by the Contractor to demonstrate to the Owner compliance with the Contract Documents. The Contractor shall provide all materials, test equipment, utilities, etc., and sufficient responsible and knowledgeable personnel from each related trade as required to demonstrate proper systems' operation.

1. This start-up test shall be in addition to the requirements for Contractor tests, Code officials inspection tests and operating instructions.
2. The Contractor shall supervise, conduct, and document the start-up tests.
3. The date for the start-up tests shall be prior to the anticipated date of Substantial Completion and in sufficient time to permit proper and full execution of the tests prior to that date. Any adjustments and/or alterations which the start-up tests indicate as necessary for the proper functioning of all equipment shall be completed prior to the date of Substantial Completion.
4. The Contractor shall provide a detailed schedule of completion indicating when each system is to be completed and outlining when and how tests will be performed. Completion schedule and test procedures shall be submitted for review at least 60 days prior to the anticipated date of system start-up.

B. All Division 26 systems shall be operated properly with loads balanced among phases and controls adjusted. All labels shall be removed and the lighting fixtures shall be clean and in operating condition.

1. Work found not operating in accordance with the requirements specified in the Contract Documents shall be corrected and additional start-up tests made, all at no additional cost to the Owner.

C. The Contractor shall submit to the Architect certificates and documents required herein at least sixty days prior to the start-up tests, unless specified otherwise.

1. The Code Authority must have signed off for final approval and occupancy of project.
2. All system tests as required by this Division must be performed and accepted.
3. Provide test reports, as contract closeout submittal type, as required by Section Specification work for the following electrical systems.

    a. Grounding System.
    b. Fire Alarm System.
    c. Wire and Cable.
    d. Generator and Transfer Switches.
    e. Switchboard and Ground Fault Protection System.

4. O&M manuals submitted.
5. Record drawings submitted.
6. On-site operating instructions and factory start-up complete and specified documentation submitted.
7. Thorough cleaning of all systems, equipment and spaces.
8. All systems identification complete.
9. All electrical connections complete and free from short circuits.
10. All Field Report and Punch List work complete.

END OF SECTION 26000

SECTION 260002 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Supporting devices for electrical components.
2. Electrical identification.
3. Electricity-metering components.
4. Concrete equipment bases.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

1.3 SUBMITTALS

A. Product Data: For electricity-metering equipment.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 COORDINATION

A. 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.

B. 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.

C. 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.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors." Coordinate this work with the Architect.

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: 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.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. 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.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. 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.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Color: Black letters on orange background.
3. Legend: Indicates voltage.

C. 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).

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. 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.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.

J. 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 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Coordination: Coordinate all utility company requirements with the utility company prior to installation.

B. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

C. Meter Sockets: Comply with requirements of electrical power utility company.

2.4 CONCRETE BASES

A. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.5 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

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. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.3 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. 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.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. 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 (8-m) maximum intervals in congested areas.
3. Colors: As follows:

a. Fire Alarm System: Red.
b. Security System: Blue and yellow.
c. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common

G. Color-code 240/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Neutral: White
4. Ground: Green

H. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed 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.

I. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.5 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.6 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

3.7 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.8 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 and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.9 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
   1. Supporting devices for electrical components.
   2. Electrical identification.
   3. Electricity-metering components.
   4. Concrete bases.
   5. Electrical demolition.
   6. Cutting and patching for electrical construction.
   7. Touchup painting.

B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.10 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.11 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260002

SECTION 260519 - WIRES AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide wires and cables as shown on the Drawings and as specified.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. General Cable Corp.
2. Senator Wire and Cable Co.
3. Southwire
4. Allied Wire and Cable
5. Alcan
6. AFC Cable Systems
7. Republic Wire Inc.
8. Service Wire Co.

B. Substitutes may be submitted for review and approval.

C. Wires and cables must be listed and labeled for their intended use per NEC Article 100.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Manufacturer's literature

B. Contract Closeout Submittals:

1. Record drawings

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. General: Provide copper conductors with 600-volt insulation as indicated on the drawings.

1. Branch circuit conductors shall be a minimum No. 12 AWG unless otherwise noted; homeruns to panelboards shall be minimum No. 10 AWG when the length exceeds 75 feet

unless otherwise noted on drawings.

2. Conductors No. 8 AWG and larger shall be stranded; No. 10 AWG and smaller shall be solid.
3. All conductors shall be color coded in accordance with the applicable electrical code requirement.

    a) All conductors No. 8 AWG and smaller shall have continuously color-coded insulation.

2.2 INSULATION

A. Branch circuit conductors up to and including No. 10 AWG shall have type THW or THHN insulation; conductors larger than No. 10 AWG shall have THWN insulation.

B. Feeder conductors shall have type THW insulation. Feeders in underground ducts or conduits outside the limits of the buildings shall have THWN or XHHW insulation.

C. Interlocked armored cable shall be type AC, MC, or HCF.

D. All wire and feeder ampacities shall be limited to the 75°C Table 310-15(B)16 and the limitations of 110.14(C)(1) of the NEC latest edition,

2.3 COLOR CODING

A. All conductors No. 8 AWG and smaller shall have continuously color coded insulation as follows:

1. 120/240 volt system:

    a) Phase A: Black
    b) Phase B: Red
    c) Neutral: White
    d) Ground: Green

B. All conductors larger than No. 8 shall have color coded tape as described above installed on conductors at all equipment terminations and where conductor passes through pull boxes.

2.4 CABLES

A. Type SE cable shall be permitted for panelboard and load center feeders where indicated on Drawings. Type NM-B cable shall meet or exceed UL Standard 44, UL Standard 854, Federal Specification A-A-59544 and the requirements of the National Electric Code.

B. With exception to patient care areas, pre-manufactured steel armor, specification grade metal clad cable (MC-TUFF) may be utilized for all normal branch circuits in dry hollow stud wall locations, above accessible ceiling and where permitted by Article #320 & #517 of the National Electrical Code (applicable Edition) only. Minimum conductor size shall be No. 12 AWG copper with integral green insulated continuous ground conductor and bare bonding conductor in direct contact with the outer metal jacket.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check to see that the conductors and insulation are proper type for the project.

3.2 INSTALLATION

A. All conductors, including low-voltage wiring for control and signal circuits, shall be installed in raceway unless specifically indicated or specified otherwise.

B. Conductors shall not be installed in conduits, ducts, or raceways until the raceway system has been completed. When installing conductors, the electrical contractor shall exercise due care to prevent damage to the conductor or insulation. Pull all conductors into raceway at same time.

C. All feeder cables shall be continuous from origin to panel or equipment termination without running splices in intermediate pull or splice boxes. Where taps and splices are necessary and approved, they shall be made in approved splice boxes with suitable connectors as herein specified.

D. Splices and taps for No. 8 AWG conductors and smaller shall be made with pressure-type, solderless, insulated connectors of suitable size. Connectors shall be the wing-nut type rated 600 volts and shall be manufactured by "Ideal Industries, Inc.", Series 400.

1. Where installed in in-grade boxes, these splices shall be of the wing-nut waterproof type, DryConn Waterproof connectors or approved equal

E. 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.

F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards in accordance with NECA Standards

I. Splices and taps for No. 6 AWG conductors and larger shall be the solderless, pressure type and shall be taped to the insulation value of the conductors. Connectors for No. 6 AWG to No. 1 AWG conductors shall be Burndy Company type "KSU", and No. 2 AWG conductors and larger shall be Burndy Company type "KVSU."

1. Where installed in in-grade boxes, these splices shall be of the waterproof connector block, Polaris Blue or approved equal.

J. Provide underground line marking tape for all direct buried cables and conduits. Tape shall not be less than 6" wide by 4 mils thick.

K. Wiring at Outlets: Install conductors at each outlet with at least 8 inches of slack

3.3 CONNECTION

A. Connectors for conductors 8 AWG and larger shall be compression-type lugs, two-hole type lugs for #2/0 AWG and larger, and one-hole type lug for #1/0 AWG and smaller. Lugs shall be no more than one AWG size larger or smaller in capacity than the conductor.

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.

C. If incompatible mechanical lugs are installed in vendor-supplied equipment, they shall be replaced by vendor with high-compression type lugs, and equipment shall be approved for use with these lugs by UL.

D. All connectors and apparatus, such as switchboards, panelboards, circuit breakers, etc., shall be equipped with UL-approved compression lugs for use with wire being furnished.

E. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

3.4 WIRE AND CABLE TEST

A. Insulation resistance of all conductors shall be tested. Each conductor shall have its insulation resistance tested immediately after the installation is completed.

B. Cables shall not be connected to any equipment. The insulation resistance (IR) acceptance test shall be conducted with a test instrument which will measure the IR of an insulated conductor to any possible combination of conductors in the cable or conduit. All conductors not under test and any shields, ground wires, metallic conduit, etc., shall be grounded to the system ground. The recommended test voltage is 500 Vdc. The minimum acceptable insulation resistance is to be based upon the following formula:

$$IR = (V + 1000)/L$$

where IR = Minimum acceptable Insulation Resistance in Megohms

V = Rated cable voltage in volts

L = Length of circuit in feet

All safety precautions associated with the test equipment and with personnel shall be followed during performance of the test.

C. Conductors that do not exceed the calculated insulation resistance values shall be removed and replaced and test repeated. All tests shall be performed in presence of Architect/Engineer. The Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed, and shall forward four copies of test readings to the Engineer for review.

D. These test reports shall identify each feeder conductor tested, conductor size, insulation type, length, date and time of test, weather conditions, and relative humidity. Each test shall be signed by party making test and person witnessing it. Any conductor or splice which is found defective shall be promptly removed and replaced, and additional tests shall be performed.

E. The above testing and report requirements shall apply to all main feeders. Branch circuits, control circuits, and signal circuits shall be checked in accordance with the National Electrical

Code, latest edition.

END OF SECTION 201519

SECTION 260526 - GROUNDING AND BONDING

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 grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SUBMITTALS

A. Revise this Article to suit Project and office practice. Frequently, no product submittal is required for this Section.

B. Product Data: For each type of product indicated.

C. Retain paragraph above if Product Data are required for each product specified. Retain paragraph below if Product Data are required only for selected products.

D. Product Data: For the following:

1. Ground rods.

2. Chemical rods.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

F. Field Test Reports: Submit written test reports to 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.

1.4 QUALITY ASSURANCE

A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency. Delete if Contractor is allowed to perform ground-resistance testing.

B. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

C. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

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.

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. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.

b. Boggs, Inc.

c. Chance/Hubbell.

d. Copperweld Corp.

e. Dossert Corp.

f. Erico Inc.; Electrical Products Group.

g. Framatome Connectors/Burndy Electrical.

h. Galvan Industries, Inc.

i. Harger Lightning Protection, Inc.

j. Hastings Fiber Glass Products, Inc.

k. Heary Brothers Lightning Protection Co.

l. Ideal Industries, Inc.

m. ILSCO.

n. Kearney/Cooper Power Systems.

o. Korns: C. C. Korns Co.; Division of Robroy Industries.

p. Lightning Master Corp.

q. Lyncole XIT Grounding.

r. O-Z/Gedney Co.; a business of the EGS Electrical Group.

s. Raco, Inc.; Division of Hubbell.

t. Robbins Lightning, Inc.

u. Salisbury: W. H. Salisbury & Co.

v. Superior Grounding Systems, Inc.

w. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Wire and Cables."

B. If only copper conductors are permitted in Division 16 Section "Conductors and Cables," delete paragraph below.

C. Material: Aluminum, copper-clad aluminum, and copper.

D. Equipment Grounding Conductors: Insulated with green-colored insulation.

E. 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.

F. Grounding Electrode Conductors: Stranded cable.

G. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

H. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.

2. Assembly of Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

I. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.

2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

3. 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.

4. Tinned 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.

J. Aluminum Bonding Conductors: As follows:

1. Bonding Cable: 10 strands of No. 14 AWG aluminum conductor, 1/4 inch (6.4 mm) in diameter.

2. Bonding Conductor: No. 4 or No. 6 AWG, stranded aluminum conductor.

3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

K. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. No. 4 AWG minimum, soft-drawn copper conductor.

2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

1. Size: 5/8 by 96 inches (16 by 2400 mm) in diameter.

B. 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.

C. Test Wells: Provide handholes as specified in Division 33Section "Underground Ducts and Utility Structures."

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct cont 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, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

F. 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 specified height above the floor.

3. Underground Grounding Conductors: Use [tinned-] copper conductor, No. 2/0 AWG minimum.

G. Portions of exposed grounding conductors and bonding jumpers shall be protected from physical damage.

H. For connection and inspection purposed concrete-encased electrode of either the conductor type, reinforcing rod or bar installed as required shall be permitted to be extended from its location within the concrete to an accessible location above the concrete.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. 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.

B. Install equipment grounding conductors in all feeders and circuits.

C. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

D. 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.

E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

F. Air-Duct Equipment Circuits: Install an 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.

G. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

H. Coordinate paragraph and subparagraphs below with Drawings and Specification Sections for systems referenced. Edit to suit Project.

I. 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.

1. 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.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

J. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

K. 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.

L. Extension of a grounding electrode conductor from another branch circuit is permissible for grounding of non-grounding receptacle replacement or extension of branch circuit provided branch circuits originate within same panelboard.

3.3 COUNTERPOISE

A. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches (450 mm) below grade and 24 inches (600 mm) from building foundation.

3.4 INSTALLATION

A. 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 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 wel except at test wells and as otherwise indicated. Make connections without exposing s or damaging copper coating

B. 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.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and 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.

D. 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 grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. 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 bondin straps.

G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.5 CONNECTIONS

A. General: 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 mecha 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

B. 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.

C. 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.

D. 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.

E. 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].

F. 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.

G. 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.

3.6 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. 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, nonshrink grout

B. 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 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.

C. 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. B counterpoise not less than 18 inches (450 mm) below grade and 6 inches (150 mm) from foundation.

3.7 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

B. 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 specified, at service disconnect enclosure grounding terminal, and at ground test wells. 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 and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

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. Substations and Pad-Mounted Switching Equipment: 5 ohms.

e. Manhole Grounds: 10 ohms.

4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.8 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 16060

SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 01 Specification Sections apply to work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide all raceways as shown on the drawings and as specified herein.

B. Provide empty raceway/box system with pull strings for telecommunications and data device cabling.

C. Provide 4" PVC conduit(s) as indicated on drawings for telecommunications service entrance. Coordinate location and routing with Telephone utility company.

D. Provide 4" PVC conduit(s) as indicated on drawings for low voltage wiring . Coordinate location and routing with Owner.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Quality Control Submittals:

1. Provide coordinated Drawings, at a minimum of 1/4-inch equals one-foot scale indicating all sleeves and conduit runs of 2 inches and larger in size.
2. Provide detailed and dimensioned layout drawings of all emergency and fire alarm system raceways. Reference all dimensions to hold-points shown on structural drawings.

B. Contract Closeout Submittals:

1. Record drawings

C. Refer to Division 01 specifications for additional requirements.

PART 2 - PRODUCTS

2.1 RACEWAY SYSTEMS

A. Conduit:

1. Rigid conduit shall be steel, heavy wall, zinc coated in accordance with UL Standard No. 6.

   a) Fittings for rigid conduit shall be steel-threaded type.

2. Intermediate metal conduit shall be steel, zinc coated in accordance with UL Standard No. 1246.

   a) Fittings for intermediate metal conduit shall be steel-threaded type.

3. Electrical metallic tubing shall be thin wall, zinc coated steel in accordance with UL Standard No. 797.

   a) Fittings for electric metallic tubing shall be the steel, insulated throat, compression type up to 2" conduit.
   b) For 2 ½" conduit and larger, set screw fittings and compression type fittings are acceptable.

4. PVC conduit shall be schedule 40 or 80 (as indicated), NEMA specification TC-Z, Federal Specification WC-1094A UL-651, with the exception of service entrance conduit.
5. Aluminum conduit in any form shall not be permitted.
6. Where flexible connections are used to connect items in normally dry locations, they shall be made with galvanized flexible metallic conduit. For exterior use or use in damp areas, such conduit shall have an exterior plastic envelope and shall be treated as liquid-tight.

   a) Fittings for flexible conduit must be specifically designed for this type of conduit and for the location where it is installed. Minimum size of flexible conduit shall be 3/4-inch.

7. Conduit and tubing shall be minimum 3/4- inch electrical trade size and shall be increased in size as required by the electrical codes to accommodate the wiring to be installed.
8. Where permitted by code and this Specification, branch circuit wiring runs above suspended ceilings, in stud partitions, or in furred spaces may be interlocked armored cable (AC or MC type).

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Installer shall examine conditions under which raceways are to be installed and notify Architect/Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and the Architect/Engineer.

B. Check to see that the proper-type and size raceway is used for system being installed for project.

C. Coordinate raceway rough-in with other trades.

3.2 INSTALLATION

A. In general, all raceways shall be run concealed within walls, ceilings, or floors, unless otherwise indicated or specified.

B. Raceway installation must be complete prior to installation of conductors.

C. All work exposed to weather shall be rigid, heavy-wall galvanized steel conduit or "Plastic-bond" steel conduit.

1. Fitting for "Plastic-Bond" conduit shall be steel threaded type with "Plastic-bond" coating of same manufacturer as raceway.

D. All raceway in contact with earth shall be rigid, heavy-wall, galvanized steel conduit painted with a minimum of two coats of bitumastic paint, or PVC Schedule 40 or 80 conduit.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Install temporary closures to prevent foreign matter from entering raceways.

G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

H. 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. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

I. 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.

J. All raceways shall be attached directly to or hung from the building structure using any one or a combination of the following methods.

1. Where electric metallic tubing one-inch diameter and smaller is attached directly to the structure, one-hole steel snap straps may be used. Tubing larger than one-inch diameter shall be attached with one- hole malleable iron pipe straps. In lieu of straps, suitable

beam clamps may be used.

2. Where rigid conduit is attached directly to the structure, malleable iron pipe straps sh be used.
3. Where single raceways cannot be attached directly, they shall be suspended from the structure by the use of an assembly composed of pipe hanger clamps, all thread rods, and beam clamps. All material shall be as manufactured by Kindorf or approved equal.
4. Where multiple raceways running parallel and at the same elevations with one another, they may be supported on steel trapeze-type assemblies. Assemblies shall be the Kindorf channel erector system or approved equal. Beam clamps, inserts, rods, straps, nuts, bolts, and channels shall be included to provide a complete combined weight of all conduits and wire, the assembly itself, plus an additional 100 pounds.
5. Raceways shall be installed in runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. All raceways shall be supported at intervals not more than 8 feet for straight run and not more than 18 inches from each side of a coupling or bend. Supports shall be securely attached to the surfaces of the structure by means of sheet metal screws on wood, bolts, and expansion shields on concrete or brick; toggle bolts on hollow masonry units; and machine screws or welded threaded studs on steel. During construction, ends of raceway shall be closed with the use of approved caps.

    a) All vertical conduits shall be substantially supported at floor lines to carry the weight of raceway and contents.

6. Termination of raceways at outlet boxes, pullboxes, and cabinets shall be accomplished by means of two locknuts (inside and outside) and bushing at each termination.
7. Empty raceways shall have installed therein a 120- pound test poly-pull (nylon) drag with min. 12" slack on ends for future use by others.
8. Expansion fittings shall be provided where raceways cross building expansion joints.
9. Flexible Conduit shall be used for final connections to the following equipment.

    a) Motor, transformer, appliances, generator connections shall be accomplished by use of flexible metallic conduit having length as short as possible.
    b) Motors in mechanical equipment rooms shall be connected with liquid-tight, flexible-metallic conduit.
    c) Continuity of ground shall be maintained by installing a grounding conductor sized in accordance with N.E.C.

10. Where practical, homeruns to the same panelboard may be grouped. No more than three single-phase circuits or one three-phase circuit shall be enclosed in one raceway unless noted. Homeruns from switch boxes will not be acceptable, unless specifically noted or indicated on the Drawings.
11. Raceways shall not be run horizontally in masonry walls.
12. Raceways shall not be installed under boiler pads or other heavy equipment, such as compressors or chillers.
13. Other Raceway Systems: Raceway systems other than conduit or tubing shall be as herein specified and as shown on the Drawings.
14. Extend telecommunication sleeves 3" above floor, ream and bush ends, and cap.
15. Extend telecommunications conduits 2" through wall, ream and bush ends, and cap.

3.3 CLEANING

A. Clean all dirt and debris from raceway systems before installing conductors.

B. Repair all damaged finishes and coatings.

END OF SECTION 260533

SECTION 260534 - JUNCTION AND PULL BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 01 Specification Sections apply to work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide junction and pull boxes as required to facilitate the pulling of wire as shown on the Drawings and as specified herein.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Cooper Crouse-Hinds
2. Thomas and Betts
3. Steel City
4. Hoffman
5. Hubbell - Raco
6. Hubbell - Bell
7. Appleton
8. O-Z/Gedney

B. Substitutions are permitted subject to review and approval by the Architect and Engineer.

1. Refer to Division 1 specifications for additional requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all junction and pull boxes that are required for the installation.

B. Type:

1. Boxes exposed or concealed in walls or ceilings for use with rigid conduit or electric metallic tubing shall be the hot-dipped, galvanized-steel type with required knock-outs for raceway terminations and shall be minimum 4 inches square, 1-1/2 inches deep.
2. Boxes concealed in ceilings, stud partitions, or furred out spaces for use with interlocked armored cable or Type NMB cable shall be the hot-dipped, galvanized type with removable partitions for ganging and suitable cable clamps and shall be 3 inches high, 2 inches wide, and 2-1/2 inches deep unless otherwise noted.
3. Dimensions of boxes shall be increased as required by applicable codes for the num of conductors accommodated.

4. All unused holes in the boxes shall be plugged or capped with approved accessories.
5. Provide cast outlet boxes in exterior locations, where exposed to weather and in wet locations. Provide with gasketed cover.

C. Special Requirements:

1. The Contractor is cautioned to note where special types of boxes are required and provide the approved type of boxes as required.
2. Boxes installed concealed in ceilings or walls shall be provided with proper extension rings and/or plaster covers where required.

D. Pull boxes shall be constructed of code gauge galvanized steel of not less than the minimum size required by the applicable codes. Provide screw fastened covers unless otherwise indicated. Where two or more feeders pass through a pull box, each shall be clearly identified with tags giving the electrical characteristics, source, and destination.

E. Pull boxes required for special systems, such as telephone, security, etc., shall be located and sized in accordance with all requirements of these systems. Contractor shall coordinate these required with system user and shall provide requirement pull boxes or junction boxes complete as part of this section of the Specification.

F. Pull boxes shall be painted for color coding to separate Tel/Data/Fire Alarm/Emergency/Normal Power by painting the covers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Installer shall examine conditions under which junction and pull boxes are to be installed and notify Architect/Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and the Architect/Engineer.

B. Check to see that the type of box is correct size for its intended use on the project.

C. Coordinate location of boxes with architectural drawings and other trades to avoid conflict.

3.2 INSTALLATION

A. Install junction boxes in accordance with the plans and sized in accordance with National Electrical Code and NECA "Standard of Installation".

B. Install pull boxes to ensure an aggregate total of not more than 270 degrees of conduit bends are exceeded between any two pull boxes.

C. Pull boxes in telephone signal and security conduit runs shall also be installed to ensure no pull exceeds 100 linear feet in addition to the restricted number of bends totaling 180 degrees and meet all requirements of the telephone company and security system supplier.

D. Location of outlets shown on the drawings is approximate unless specifically dimensioned on t[illegible] Architectural drawings. Any changes deemed necessary shall be subject to the approval of th Architect. All outlet boxes must be installed so as to permit a smooth and even application of finish surface; and all outlet plates must be installed plumb and tight to finish surface with no visible gaps.

1. Junction and pull boxes shall be installed in a plumb, rigid and satisfactory manner by use of sheet metal screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws, welded threaded studs or cast steel beam clamps on steel work.
2. Junction and pull boxes installed in concrete masonry unit, structural or glazed tile construction shall be of sufficient depth to place box in void space of the tile or block.
3. In walls or ceilings of concrete, drywall, tile, or other non-combustible material, boxes shall be so installed that the front edge of the box will not set back from the finished surface more than 1/4 inch. In walls and ceilings constructed of wood or combustible material, outlet box must be flush with finished surface.
4. Junction and pull boxes shall be labeled on the outside cover indicating voltage, panelboard designation and circuit number.

E. Per the UL White Book, for metallic single and two-gang boxes in wood and steel stud walls and partitions not exceeding a 2-hour fire rating;

1. The aggregate surface area of the boxes shall not exceed 100 square inches in any 100 square foot area of wall surface.

   a) The aggregate surface area of the boxes may exceed 100 square inches in an 100 square foot area of wall surface when Wall Opening Protective Materials (CLIV) are used and installed per the requirements of their classification.

   b) Metallic boxes shall not be installed on opposite sides of walls or partitions of staggered stud construction unless Wall Opening Protective Materials (CLIV) are used and installed per the requirements of their UL classification.

END OF SECTION 260534

SECTION 260535 - OUTLET BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide outlet boxes as shown on the Drawings and as specified.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Cooper - Crouse-Hinds
2. Thomas and Betts - Steel City
3. Hubbell - Raco
4. Hubbell - Appleton
5. Thomas and Betts - Carlon (pool areas only)
6. Kraloy (pool areas only)

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Provide all outlet boxes and pull boxes as required for the installation.

2.2 TYPE

A. Outlet boxes exposed or concealed in walls or ceilings, for use with rigid conduit, or electric metallic tubing shall be the hot-dipped, galvanized-steel type with required knock-outs for raceway terminations and shall be minimum 4 inches square and 1-1/2 inches deep (non-metallic in pool area).

B. Outlet boxes concealed in ceilings, stud partitions, or furred-out spaces for use with interlocked armored cables shall be the hot-dipped, galvanized type with removable partitions for ganging and suitable cable clamps and shall be 3 inches high, 2 inches wide, and 2-1/4 inches deep (non-metallic in pool area).

C. Outlet boxes for flush-floor installation shall be the watertight, fully adjustable type with finished-floor surface and shall be of the type indicated on the Drawings.

D. Dimensions of outlet boxes shall be increased as required by code or user's requirements for the number of conductors accommodated.

E. All unused holes in boxes shall be plugged or capped with appropriate accessories.

2.3 SPECIAL REQUIREMENTS

A. The Contractor is cautioned to note where special types of outlets are required and to provide approved type of outlet boxes as required.

B. Outlet boxes for lighting fixtures shall be provided with suitable galvanized threaded fixture studs where required.

C. Outlet boxes installed in or on vertical surfaces for support of a luminaire over 6 pounds shall be marked indicating box is suitable for installation of a luminaire.

D. Outlet boxes installed in ceiling intended for support of lighting luminaire over 50 pounds shall be marked on the interior with the weight of the luminaire it can support.

E. Outlet boxes installed concealed in ceiling or walls shall be provided with proper extension rings and/or plaster covers listed for the application where required.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check to see that the type of outlet box is correct size for its intended use on the project.

B. Coordinate location of outlet boxes with architectural drawings and other trades to avoid conflict.

3.2 INSTALLATION

A. Location of outlets shown on the Drawings is approximate; the exact location shall be determi by the project conditions, and any changes deemed necessary shall be subject to the approval o the Architect.

1. Outlet boxes shall be installed in a rigid and satisfactory manner by use of sheet metal screws on wood, bolts, and expansion shield on concrete or brick; toggle bolts on hollow masonry units; and machine screws or welded threaded studs on steel work.
2. Outlet boxes installed in cinder block, structural, or glazed tile construction shall be of sufficient depth to place box in void space of the tile or block.
3. In walls or ceilings of concrete, tile or other non-combustible material, boxes shall be so installed that the front edge of the box will not set back from the finished surface more than 1/4-inch. In walls and ceilings constructed of wood or other combustible material, outlet boxes shall be flush with the finished surface or project therefrom. Boxes shall not protrude from the wall.
4. Outlet boxes shall be labeled on the outside cover indicating voltage, panelboard designation and circuit number.

B. Per the UL White Book, for metallic single and two-gang boxes in wood and steel stud walls and partitions not exceeding a 2-hour fire rating;

1. The aggregate surface area of the boxes shall not exceed 100 square inches in any 100 square foot area of wall surface.
2. The aggregate surface area of the boxes may exceed 100 square inches in any 100 square foot area of wall surface when Wall Opening Protective Materials (CLIV) are used an installed per the requirements of their classification.

3.3 CONNECTIONS

A. Connect conduits to outlet boxes.

3.4 CLEANING

A. Clean all dirt and debris from outlet box before installing conductors or cover plates.

END OF SECTION 260535

SECTION 260543 - SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide the electrical service entrance(s) and duct bank requirements as shown on the drawings and specified.

1.3 STANDARDS

A. Coordinate all work for electric service(s) with the local power company servicing the Project and provide service entrance duct banks, pads, racking and conductors to the transformer(s) to their standards and regulations.

1.4 SUBMITTALS

A. Quality Control Submittals:

1. Service and equipment shop drawings showing the arrangement in plan and elevation of all metering, main service equipment duct banks. Drawings shall include manufacturer's name, ratings, physical dimensions, electrical ratings and all other pertinent layout information to include verification of clearance in designated room or space.

B. Contract Closeout Submittals:

1. Record drawings
2. Manuals
3. Documentation of inspections by, and tests performed for the Authority Having Jurisdiction.

C. Manufacturer Seismic Qualification Certification: Submit certification that service equipment, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration Isolation and Seismic Restraints for Electrical Systems". Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - REQUIREMENTS

2.1 ELECTRIC SERVICE

A. Provide electric service as shown on the drawings and as specified.

B. Electric Service Costs:

C. The contractor shall provide all fees, labor and materials associated with bringing service to the facility.

D. Main Service Equipment:

1. Provide main service equipment of the size and type indicated on the drawings, this equipment shall bear a UL label for service entrance equipment.

2. Confirm available short circuit current from the utility company and provide all service equipment with AIC ratings that exceed the available short circuit current at the particular pieces of equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

1. In other than dwelling units provide durable field marking(s) label indicating the maximum available fault current and the date the fault-current calculation was performed.

2. Maintain required dedicated working space around and in front of service equipment

3.2 INSPECTION

A. Check all shop drawings provided to ensure all work required to be performed by the Contractor meets all requirements.

3.3 CLEANING

A. Clean all dirt and debris from the inside of all raceways for service entrance cables.

END OF SECTION 260543

SECTION 260548 - VIBRATION ISOLATION & SEISMIC RESTRAINTS FOR ELECTRICAL SYSTE!

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections apply to work of this Section.

1.2 DESCRIPTION

A. Intent

1. All equipment and conduit as noted on the drawings schedule or in the specification shall be seismically braced. Vibration control shall apply as described herein.
2. Seismic bracing and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
3. It is the intent of the seismic portion of this specification to keep all electrical building system components in place during a seismic event and operational where this specification so requires.
4. All such systems must be installed in strict accordance with seismic codes, component manufacturer's and building construction standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.
5. This specification is considered to be minimum requirements for seismic consideration.
6. Any variance or non-compliance with this specification requirement shall be corrected by the contractor in an approved manner.

B. The work in this section includes, but is not limited to the following:

1. Vibration isolation for conduit and equipment.
2. Equipment isolation bases.
3. Seismic restraints for isolated equipment.
4. Seismic restraints for non-isolated equipment.
5. Certification of seismic restraint designs and installation supervision.
6. Certification of seismic attachment of housekeeping pads.
7. All equipment (components) requiring IBC certification.
8. All inspection and test procedures for equipment (components) requiring IBC certification.
9. All electrical and fire alarm equipment and systems within or on the building. Equipment buried underground is included. Entry of services to building, up to but not including the utility connection point is part of this Specification.
10. Equipment referred to below is typical. (Equipment not listed is still included in this specification)

    a. All systems listed in or part of this paragraph are referred to as components:
    Battery Chargers
    Battery Racks
    Cable Trays
    Conduit
    Electrical Panels
    Equipment Supports

Fire Alarm Panels
Generators
Light Fixtures
Motor Control Centers
Risers
Supports
Switch Gear
Transformers
Unit Substations
Variable Frequency Drives

C. Definitions (all codes).

1. Life Safety Systems:

   a. All systems involved with fire protection including fire alarm panels.
   b. All electrical or fire alarm systems that support the operation of or are connected to emergency power equipment including all lighting, generators, transfer switches and transformers.

2. Positive Attachment:

   a. Positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double-sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, Ductwork, fire protection or any other equipment are not acceptable on this project as seismic bracing points.

3. Transverse Bracing:

   a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe or duct.

4. Longitudinal Bracing:

   a. Restraint(s) applied to limit motion parallel to the centerline of the pipe or duct.

5. Definitions, IBC (in addition to the above).

   a. Anchor: A device, such as an expansion bolt, for connecting duct or pipe bracing members into the structure of a building.
   b. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
   c. Attachment: see Positive Attachment below.
   d. Bracing: Metal channels, cables or hanger angles that prevent ducts and pipes from breaking away from the structure during an earthquake. See also Longitudinal Bracing and Tranverse Bracing. Together, they resist lateral loads from any direction.
   e. Certificate of Compliance: A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents, provided by an approved agency.
   f. Component: A part or element of an architectural, electrical, mechanical, or structural system.
   g. Component, equipment: A mechanical or electrical component or element that is part of a mechanical and/or electrical system within or without a building system.
   h. Component, flexible: Component, including its attachments, having a fundamental period greater than 0.06 seconds.

i. Component, rigid: Component, including its attachments, having a fundamental period less th-- or equal to 0.06 seconds.
j. Dynamic properties of piping: The tendency of pipe to change in weight and size because of t... movement and temperature of fluids in them. This does not refer to movement due to seismic forces.
k. Equipment: Systems associated with ducts, pipes and conduit, also called components.
l. Hazardous Contents: A material that is highly toxic or potentially explosive and in sufficient quantity to pose a significant life-safety threat to the general public if an uncontrolled release were to occur.
m. Inspection Certificate: An identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency (see Section 1703.5 and "Label" and "Manufacturer's Designation and "Mark").
n. Label: An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency *(see Section 1703.5 and "Inspection Certificate" and "Manufacturer's Designation and "Mark").*
o. Lateral forces: A force acting on a duct or pipe in the horizontal plane. This force can be in any direction.
p. Load: Gravity Load (*W*): The total dead load and applicable portions of other loads as defined in *Section 1613.*
q. Longitudinal bracing: Bracing that prevents a duct or pipe from moving in the direction of its run.
r. Longitudinal force: A lateral force that happens to be in the same direction as the duct or pi
s. Manufacturer's Designation: An identification applied on a product by the manufac indicating that a product or material complies with a specified standard or set of rules (see also "Inspection Certificate" and "Label").
t. Occupancy Importance Factor: A factor assigned to each structure according to its Seismic Use Group as prescribed in the IBC.
u. Positive Attachment: A mechanical device, designed to resist seismic forces that connects a non-structural element, such as a duct, to a structural element, such as a beam. Bolts and screws are examples of positive attachments. Glue and friction due to gravity do not create positive attachments.
v. Seismic Design Category: A classification assigned to a structure based on its Seismic Use Group and the severity of the design earthquake ground motion at the site.
w. Seismic Forces: The assumed forces prescribed herein, related to the response of the structure to earthquake motions, to be used in the design of the structure and its components.
x. Seismic Use Group: A classification assigned to a building based on its use as defined in Section 1613.
y. Seismic: (adj.) Related to an earthquake. Seismic loads on a structure are caused by wave movements in the earth during an earthquake.
z. Site Class: A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 1613.
aa. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.
bb. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

cc. Special Inspection: Inspection as herein required of the materials, installation, fabrication, erection or placement of components and connections requiring special documents and referenced standards (see Section 1704).
dd. Story Drift Ratio: The story drift divided by the story height.
ee. Transverse bracing: Bracing that prevents a duct or pipe from moving from side to side.

1.3 QUALITY ASSURANCE

A. Projects substitution of internally or externally isolated and restrained equipment supplied by the equipment vendor, in lieu of the isolation and restraints specified in this section, is acceptable provided all conditions of this section are met as well as additional requirements of Division 01 Specifications. The Equipment manufacturer shall provide a letter of guarantee from their Engineering Department PE stamped and certified per the section on Seismic Restraint Design (See paragraph 1.3) stating that the seismic restraints are in full compliance with these specifications. Where IBC is required, manufacturer certification shall be in addition to all requirements, which are stated in Paragraph 1.3 of Article 4.

Letters from field offices or representatives are unacceptable. All costs for converting to the specified vibration isolation and/or restraints shall be borne by the equipment vendor in the event of non-compliance with the preceding. Internal isolation is not acceptable for:

1. Indoor or outdoor mounted equipment over or adjacent to:

a. Patient or operating areas
b. Theatre space
c. Office locations
d. Assembly areas

B. Letters from representatives are unacceptable.

1.4 Submittal Data Requirements

A. Refer to Part I General Requirements.

B. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:

1. Descriptive Data:

a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.

2. Shop Drawings:

a. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
b. Provide all details of suspension and support for ceiling hung equipment.
c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

3. Seismic Certification and Analysis:

a. Calculations by the Manufacturer's qualified licensed Engineer substantiating the mounting system, seismic restraints and recommended anchor bolts shall be submitted for approval along with the shop drawings. Calculations shall be based on the loads as established in Section 4d – Design Loads at the end of this section. All analysis shall be stamped by a registered professional having a PE from the same state as the project.

b. Unless otherwise specified, all equipment and piping shall be restrained to resist seismic forces. Restraints shall maintain piping in a captive position. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of:

1) Uniform Building Code
2) Applicable state and local codes
3) NFPA, (fire protection only).
4) IBC 2015 International Building Code (See paragraph 4).
5) ASCE Standard 7 "Minimum Design Loads for Buildings and Other Structures" (See paragraph 4).

4. International. Building Code Additions:

a. In addition to all of the above provisions, all trades shall comply with sections 16 & 17 of the International Building Code and ASCE Standard 7 "Minimum Design Loads for Buildings and Other Structures" using only vendors that comply with the provisions stated herein and submi the special inspections listed within these specifications. Where compliance is not possible, ea... contractor shall submit a vendor report clearly indicating that none of the specified, listed or other vendors known to the contractors meet the compliance, testing and certification portions of the IBC specifications Section 16 and 17 and ASCE 7-05. Special inspections shall still be conducted (Paragraph 4 b) even if no vendors meet the following requirements. All non-isolated and isolated equipment, (components) shall be secured to the structure in accordance with that code!

1) All component manufacturers will submit for approval the following as required below:

a) All life safety system components noted in this specification will have the manufacturer of that component submit the Approved Agencies Certificate of Compliance for the specific equipment on this project when the Seismic Design Category is "C–F". Analytical or Shaker Test certification thru the component's load path including structure at its center of gravity shall include anchorage, structural and online capability.

b) For Seismic Hazard Exposure Group III projects, all components noted in this specification will have the manufacturer of that component submit the Approved Agencies Certificate of Compliance for their equipment when the Seismic Design Category is "C-F". This requirement also pertains to projects that combine an emergency preparedness center within a structure of another Use Group where that component is needed for continued operation of the building or whose failure could impair the continued operation of the building. Note: the definition of the above refers to any component which does not allow or hampers the use or capability of the intended purpose of that structure Analytical or Shaker Test certification thr

the total component's load path to structure at its center of gravity shall include anchorage, structural and on line capability.

c) All components containing Hazardous or Flammable materials will have the manufacturer of that component submit the Approved Agencies Certificate of Compliance for their equipment when used on any project having a minimum Seismic Design Category of "C-F". Analytical or Shaker Test certification through the total component's load path to structure at its center of gravity shall include anchorage, structural on line capability to insure against loss of hazardous or flammable (explosive) material. Test shall prove that no internal component will fail which could support combustion and/or explosion.

d) All components not listed in the above categories shall have the manufacturer of each component submit a PE stamped calculation package that their project specific equipment will accept anchorage through the component's load path to structure at its center of gravity at the designated anchorage locations. This requirement is for all projects having a Seismic Design Category of C-F.

2) The following systems shall require Special Inspection and Periodic Special Inspection for anchorage during the course of construction, as defined earlier in this section for all buildings in Seismic Design Categories C-F.

a) All electrical components for standby or emergency power systems require Periodic Special inspection. *
b) All electrical equipment in Seismic Design Categories E and F. (Periodic)*
c) All equipment using combustible or toxic energy sources. (Special. -1)
d) All electric motors, transformers, switchgear unit substations and motor control centers. (Special. -1)
e) Reciprocating and rotating type machinery. (Special -1)
f) Pipe, 3" & larger. (Special. -1)
g) Isolator units for seismic isolation system (Periodic)*
h) Manufacturer's Quality Control Program for projects in Seismic Design Categories E or F.

3) Contractor Responsibilities and Approvals:

a) Each contractor responsible for the installation of the components asterisked above, (*) shall be responsible for submitting to the design team for their approval, a written contractor's statement of responsibility as outlined below. In addition all (-1) items above require special inspection in accordance with IBC-2009 Section 1707.7.
b) Identify the components that are part of the Quality Assurance Plan. (asterisked above)*
c) Identify all Special Inspection and Testing for components installed as part of this contract.
d) List control procedures within the contractor's organization for all special inspection and testing including methods, frequency of reporting and their distribution of those reports.
e) List personnel and their qualifications exercising control over the seismic aspects of the project.

4) Design loads:

a) Projects located in the states of Connecticut, Delaware, New Jersey, New York and Pennsylvania, have a maximum design load of .4g for statically mounted components and .9g for resiliently mounted components. Actual loads shall be as above or as calculated but shall not be less than .4g for static and .5g for resiliently mounted components including internal components as part of a manufactured system.

b) Exclusions for seismic restraint of piping and duct shall be according to applicable codes. The minimum horizontal restraint capability shall be .4g horizontal and .27g vertical. Life safety equipment defined above shall be designed to survive a horizontal load of .9g and a vertical load of .6g.

c) Testing or calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered PE with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include shear and tensile loads as well as one test or analysis at 45° to the weakest mode. IBC Component testing must be by an Approved Agency.

d) Analysis for anchorage must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in Section 4 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

e) Vertical load shall be calculated at 2/3 the horizontal load.

f) Internally isolated equipment in lieu of specified isolation and restraint systems must meet all of the requirements of paragraph 4 (a-d) and Section 1.6.

g) A seismic design Errors and Omissions insurance certificate MUST accompany equipment manufacturer's certification. Product liability insurance certificates are not acceptable.

h) In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure. Curb or roof rail mounted equipment must not only have seismic attachment of the equipment to the roof but also to the curb or rails. The attachment and certification thereof shall be by this section. Sheet metal screw attachment is unacceptable.

i) Failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8 inch and/or horizontal permanent deformation greater that 1/4 inch or failure of the equipment to operate.

1.5 RELATED WORK

A. Housekeeping pad design shall be by the project structural engineer or as shown on the contract drawings. Attachment shall be designed and certified according to this section by the seismic/isolation supplier. Material and labor required for attachment and construction shall be by the concrete section contractor, or by this contractor where specified. Housekeeping pads shall be sized to accommodate a minimum of 6" of clearance all around the equipment or 12 times the anchor bolt diameter, whichever is greater. Where exterior isolators are used this distance shall be as measured from the outboard holes in the isolator base plate and its mounting package.

B. Structural support and connections for all equipment, including roof-mounted equipment, specified in o sections shall comply with all IBC requirements indicating load path to the structure.

C. Roof steel supporting roof-mounted equipment shall be designed for all seismic forces including, but not limited to, tension, compression and moment loads.

D. Where ceiling are not braced (Exclusion "C"- Building Category I or II $I_p = 1.0$) lighting fixtures shall have independent 4 corner diagonal wire ties to structure.

E. Lay-in ceilings in compliance with seismic zone requirements may use earthquake clips or other approved means of positive attachment to brace fixtures such as panel light and diffusers less than 75 pounds to T-bar structures. Local codes dictate support requirements.

1.6 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable Codes and Standards

1. All City, State and Local Codes (Code)
2. SMACNA Guidelines for Seismic Restraint of Mechanical Systems (To be used as a Standard, not a code)
3. NFPA 13, 13R (where applicable) and 14 for Fire Protection System (Standard)
4. American Society For Testing and Materials (ASTM) (Standard)
5. International Conference of Building Officials (ICBO) (Standard)
6. 2015 International Building Code (Code)
7. Uniform Building Code (Code)
8. ASHRAE (Standard)
9. ASCE (Standard 7)

B. In cases where requirements vary, the guideline for the most stringent shall be utilized.

C. Use IBC-2015 as reference code standard unless otherwise designated.

1.7 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:

1. Determine vibration isolation and seismic restraint sizes and locations.
2. Provide vibration isolation and seismic restraints as scheduled or specified.
3. Provide calculations and materials if required for restraint of unisolated equipment.
4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
5. Certify correctness of installation upon completion.
6. All provisions of section 1.3, section "C", Seismic Certification & Analysis

B. All manufacturers including Original Equipment Manufacturer (OEM) providing equipment and/or vibration/seismic control systems must provide a Seismic Design Error and Omissions Insurance Certificate for their firm or their design consultant to certify their ability to provide engineering and design as required by this section.

C. All manufacturers of any type of equipment including Original Equipment Manufacturers (OEM) are responsible for Section 1.1.-1.6 including 1.3, Section "C", Seismic Certification and Analysis.

1.8 EXCLUSIONS

A. As listed below:

1. PIPE, CONDUIT, CABLE TRAYS & BUS DUCTS (Components)

a. All pipe or conduit less than 2 ½" diameter suspended by individual hanger rods. All clevis supported pipe or conduit less than 12" (6" or less for fire protection piping) from the top of the pipe to the underside of the support point. Trapeze supported pipe, cable trays and bus ducts suspended by hanger rods having a distance less than 12 " in length from the underside of the pipe support to the support point of the structure.

2. ADDITIONAL EXCLUSIONS for equipment in states governed by UBC:

a. Floor mounted equipment weighing less than 400 lb. and not resiliently mounted.

3. EXCLUSIONS

a. DO NOT apply for LIFE SAFETY or HIGH HAZARD equipment as listed in Section 1.1, C regardless of governing code for HVAC, Plumbing, Electrical or Fire Protection. *(A partial list is illustrated)* High Hazard is additionally classified as any system handling flammable, combustible or toxic material. Typical systems not excluded are additionally listed below.

4. ELECTRICAL

a. Critical, standby or emergency power conduit (1" nominal diameter and larger), cable tray or bus duct, lighting, panels, communication lines involving 911, etc.

5. PIPING

a. Fuel oil, gasoline, natural gas, medical gas, steam, compressed air or any piping containing hazardous, flammable, combustible, toxic or corrosive materials. Fire protection standpipe, risers and mains. Branches must be end tied.

6. DUCT

a. Smoke evacuation duct or fresh air make up connected to emergency system, emergency generator exhaust, boiler breeching or as used by the fire department on manual override!

7. EQUIPMENT

a. Previously excluded non life safety duct mounted systems such as fans, variable air volume boxes, heat exchangers and humidifiers having a weight greater than 75 lbs require independent seismic bracing.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. The basis of this specification is Vibration Mountings & Controls. Products from nationally recognized manufacturers are acceptable provided their systems strictly comply with these

specifications and Division 01 Specifications. (See Form VL-1 listing other manufacturers to be considered for use on this project)

2.2 VIBRATION ISOLATION TYPES

A. Type A: Spring Isolator - Free Standing
VMC: ASC

1. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" neoprene acoustical friction pad between the base plate and the support.
2. All mountings shall have leveling bolts that must be rigidly bolted to the equipment.
3. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
4. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.
5. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

B. Type B: Seismically Restrained Spring Isolator
VMC: AWRS, ASCM

1. Restrained spring mountings shall have a Type A spring isolator within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/4" shall be maintained around restraining bolts and internal neoprene deceleration bushings so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces.

C. Type C: Combination Spring/Elastomer Hanger Isolator (30° Type)
VMC: RSH30

1. Hangers shall consist of rigid steel frames containing minimum 1 1/4" thick neoprene elements at the top and a steel spring with general characteristics as in Type A. The neoprene element shall have neoprene bushings projecting through the steel box.
2. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short-circuiting the spring.
3. Submittals shall include a hanger-drawing showing the 30° capabilities.
4. Hanger locations requiring pre-compression for holding piping at fixed elevation shall be type pre-compressed for all manufacturers.

D. Type D: Elastomer Double Deflection Hanger Isolator
VMC: RHD

1. Molded (minimum 1 1/4" thick) neoprene element with projecting bushing lining the rod clearance hole. Static deflection at rated load shall be a minimum of 0.35".
2. Steel retainer box encasing neoprene mounting capable of supporting equipment up to four times the rated capacity of the element.

E. Type E: Combination Spring/Elastomer Hanger Isolator
VMC: RSH

1. Spring and neoprene elements in a steel retainer box with the features as described for Type C and D isolators.
2. Hanger locations requiring pre-compression for holding piping at fixed elevation shall be type pre-compressed for all manufacturers.
3. 30° angularity feature is not required.

F. Type F: Seismically Restrained Elastomer Floor Isolator
VMC: RSM

1. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" and all directional seismic capability. The mount shall consist of a ductile iron or aluminum casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications.

G. Type G: Pad Type Elastomer Isolator (Standard)
VMC: Maxiflex

1. One layer of 3/4" thick neoprene pad consisting of 2" square modules for size required.
2. Load distribution plates shall be used as required.
3. Bolting required for seismic compliance. Neoprene and duck washers and bushings shall be provided to prevent short-circuiting.

H. Type H: Pad Type Elastomer Isolator (High Density)
VMC: Fabriflex

1. Laminated canvas duck & neoprene, maximum loading 1000 psi, minimum 1/2" thick.
2. Load distribution plate shall be used as required.
3. Bolting required for seismic compliance. Neoprene and duck washers and bushings shall be provided to prevent short-circuiting.

I. Type I: Thrust Restraints
VMC: RSHTR

1. A spring element similar to Type A isolator shall be combined with steel angles, backup plates, threaded rod, washers and nuts to produce a pair of devices capable of limiting movement of air handling equipment to 1/4".
2. Restraint shall be easily converted in the field from compression type to tension type.
3. Unit shall be factory precompressed.
4. Thrust restraints shall be installed on all cabinet fan heads, axial or centrifugal fans whose thrust exceeds 10% of unit weight.

J. Type J: Pipe Anchors
VMC: MDPA

1. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" thick 60 durometer neoprene.
2. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction.
3. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction.

K. Type K: Pipe Guides
VMC: PG

1. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of 60-durometer neoprene.
2. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement.
3. Guides shall be capable of + 1 5/8" motion, or to meet location requirements.

L. Type L: Isolated Pipe Hanger System
VMC: CIH, CIR, TIH, PIH

1. Precompressed spring and elastomer isolation hanger combined with pipe support into one assembly. Replaces standard clevis, single or double rod roller, or double rod fixed support.
2. Spring element (same as Type A) with steel lower spring retainer and an upper elastomer retainer cup with an integral bushing to insulate support rod from the isolation hanger.
3. The neoprene element under the lower steel spring retainer shall have an integral bushing to insulate the support rod from the steel spring retainer.
4. Hangers shall be designed and constructed to support loads over three times the rated load without failure.
5. System shall be precompressed to allow for rod insertion and standard leveling.

2.3 SEISMIC RESTRAINT TYPES

A. Type I: Spring Isolator, Restrained
VMC: ASCM, AWR

1. Refer to vibration isolation Type B.

B. Type II: Seismically Restrained Elastomer Floor Isolator
VMC: RSM

1. Refer to vibration isolation Type F.

C. Type III: All-Directional Seismic Snubber
VMC: Type SR

1. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. Rated loadings shall not exceed 1000 psi. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated.

D. Type IV: Floor or Roof Anchorage
VMC: FA

1. Rigid attachment to structure utilizing wedge type anchor bolts, anchored plates machine screw, bolting or welding. Powder shots are unacceptable.

E. Type V: Seismic Cable Restraints
VMC: SCR

1. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads wi[illegible] a minimum safety factor of 2 and arranged to provide all-directional restraint. Cable end connecti shall be steel assemblies that swivel to final installation angle and utilize 2 clamping bolts to provi[illegible] proper cable engagement. Cables must not be allowed to bend across sharp edges. Single arm braces with resilient bushings can be substituted for seismic cable restraints. Deck fitting shall have two through bolts spaced to ICBO standards for attachment to concrete!

F. Type VI: Rigid Arm Brace
VMC: SAB

1. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize 2 through bolts to provide proper attachment spaced to ICBO standards for attachment to concrete.

G. Type VII: Internal Clevis Cross Brace
VMC: ICB

1. Internal clevis cross braces at seismic locations shall be pre-cut pipe sized for internal clevis dimensions.

2.4 EQUIPMENT BASES

A. General

1. All curbs and roof rails are to be bolted or welded to the building steel or anchored to the concrete d (minimum thickness shall be 4") for resisting wind and seismic load forces in accordance with project location. (Fastening to metal deck is unacceptable.)

B. Base Types

1. Type B-1: Integral Structural Steel Base
VMC: WFB

a. Rectangular bases are preferred for all equipment.
b. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows.
c. All perimeter members shall be steel beams with a minimum depth equal to 1/12 of the longest dimension of the base.
d. Base depth need not exceed 12" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer.
e. Height saving brackets shall be employed in all mounting locations to provide a minimum base clearance of 2".

2. Type B-2: Concrete Inertia Base
VMC: MPF

a. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations.
b. Bases for split case pumps shall be large enough to provide for suction and discharge elbo
c. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6'

d. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity.
e. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom.
f. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured.
g. Height saving brackets shall be employed in all mounting locations to maintain a 2" minimum clearance below the base.
h. Flush profile wooden formed bases having correct depth and reinforcing requirements are acceptable.

3. Type B-5: Isolated Equipment Supports
VMC: R7200/R7300

a. Continuous structural equipment support rails that combine equipment support and isolation mounting into one utilized roof flashed assembly with all features as described for Type B-3.
b. System shall be designed for positive anchorage or welding of equipment to supports and welding of supports to the building steel.

4. Type B-6: Non-Isolated Equipment Supports
VMC: R7000

a. This shall have the same provisions as Type B-5 without the spring isolation.

PART 3 - EXECUTION

3.1 GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any isolated equipment, piping or duct, which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. General bracing may occur from flanges of structural beams, upper truss cords in bar joist construction and cast in place inserts or wedge type drill-in concrete anchors.

G. Seismic cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment or piping.

H. Seismic cable assemblies are installed taut on non-isolated systems. Seismic solid braces may be used in pla of cables on rigidly attached systems except where single arm braces incorporate resilient bushings.

I. At locations where seismic cable restraints or seismic solid braces are located the support rods must be braced when necessary to accept compressive loads.

J. At all locations where seismic cable braces and seismic cable restraints are attached to the pipe clevis, the clevis bolt must be reinforced with pipe clevis cross bolt braces or double inside nuts if required by seismic acceleration levels.

K. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted.

L. Where piping passes through walls, floors or ceilings, the contractor shall provide wall seals or resilient packed pipe sleeves.

M. Special and Periodic Inspections for items listed in Section 1.3, Article 4 shall be conducted and submitted on a timely basis.

3.2 EQUIPMENT INSTALLATION

A. Equipment shall be isolated and restrained per Tables A, B and C at the end of this section.

B. Place floor mounted equipment on 4" high concrete housekeeping pads properly doweled or expansion shielded to the deck to meet acceleration criteria (see Section 1.4). Anchor isolators and/or bases to housekeeping p Concrete work is specified under Concrete in the specifications of the contract.

C. Additional Requirements

1. The minimum operating clearance under all isolated components bases shall be 2".
2. All bases shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment, isolators and restraints.
3. The equipment shall be installed on blocks to the operative height of the isolators. After the entire installation is complete, and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free in all directions.
4. Ceilings containing diffusers must meet seismic zone requirements by using earthquake clips or other approved means of positive attachment to secure diffuser to T-bar structure.
5. All floor or wall mounted equipment and tanks shall be restrained with Type IV restraints.

3.3 PIPING AND DUCTWORK ISOLATION

A. Seismic Restraint of Piping, Conduit, Bus Duct and Cable Tray

1. All high hazard and life safety pipe regardless of size such as fuel oil piping, fire protection mains, gas piping, medical gas piping and compressed air piping shall be seismically restrained. Type V seismic cables restraints or resilient single arm braces shall be used if piping is isolated. Type V seismic cable restraints or Type VI seismic solid braces may be used on unisolated piping. There are no exclusion size or distance in this category.

2. Seismically restrain piping located in boiler rooms, mechanical equipment rooms and refrigeration equipment rooms that is 1 1/4" I.D. and larger. Type V seismic cables restraints or resilient single arm braces shall be used if piping is isolated. Type V seismic cable restraints or Type VI seismic solid braces may be used on unisolated piping.
3. Seismically restrain all other piping 2 1/2" diameter and larger. Type V seismic cables restraints or resilient single arm braces shall be used if piping is isolated. Type VI seismic cable restraints or seismic solid braces may be used on unisolated piping.
4. See Table D for maximum seismic bracing distances.
5. Multiple runs of pipe on the same support shall have distance determined by calculation.
6. Rod braces shall be used for all rod lengths greater than 3'.
7. Clevis hangers shall have spacers placed inside of hanger at seismic brace locations.
8. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
9. For fuel oil and all gas piping, transverse restraints must be at 20' maximum and longitudinal restraints at 40' maximum spacing.
10. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or TEE or combined stresses are within allowable limits at longer distances.
11. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints. Use Type V or VII restraint, if trapeze is smaller than 48" long.
12. Branch lines may not be used to restrain main lines.
13. All PVC and glass pipe less than 6" are braced only if the pipe use involves hazardous or toxic materials. All other PVC and glass pipe greater than 6" shall be braced at 20' transversely and 40' longitudinally with bottom shields.
14. Fire protection branch lines shall be end tied.

3.4 INSPECTION

A. All Independent Special and Periodic Inspections must be performed and submitted on components as outlined in Article 1.3, Section 4b.

B. Upon completion of installation of all vibration isolation devices, the local representative shall inspect the completed project and certify in writing to the Contractor that all systems are installed properly, or require correction. The contractor shall submit a report to the Architect, including the representative's report, certifying correctness of the installation or detailing corrective work to be done.

Table C
Vibration Isolation & Seismic Restraint
Requirements For Electrical Equipment
Installation Attachment Point

			ON GRADE				ABOVE GRADE			
EQUIPMENT	SIZE	MTNG	ISOL	DEFL	BASE	RESTR	ISOL	DEFL	BASE	RESTR
Transformer Dry Type	All	Flr	--	--	--	IV	D	0.30	*	IV
		Ceiling	--	--	--	V	E	0.20	*	V

FORM CQAP

Section 230548
Vibration Isolation and Seismic Restraints

Contractor Name: _____

Date: _____

Project: _____

Specification Section: _____

Contractor IBC Quality Assurance Seismic Program (230548) Specification

This form is to be filled out before the first submission in any vendor group by the installing contractor. All items listed herein shall be part of the contractor's quality assurance program.

1. Acknowledge special requirements contained in the quality assurance plan
2. Acknowledge that control will be exercised to obtain conformance with the construction documents
3. Procedures for exercising control within the contractors organization including frequency and distributions of inspections and testing reports
4. Identification and qualification of the persons exercising control of this program within their organization

Contractor to submit this program acknowledging receipt and program implementation. Each of the 4 listed programs are to be submitted including all applicable details as listed above.

_____
Signature

_____
Print Name

FORM CVC-1

Section 230548
Vibration Isolation and Seismic Restraints

Contractor Name: _____

Date: _____

Project: _____

Specification Section: _____

Notes to the installing contractor

The purpose of this form is for you the contractor to fill in all vendors that are IBC approved as part of your initial submission for any group of equipment, ie., fans, ac units, pumps, etc. By identifying which of the vendors have IBC approval, both you and the project's specifying engineer are protected. Only IBC approved vendors can participate on this project. In the event that no vendor in any group has IBC certification than any vendor who meets the project's performance specifications is acceptable.

Note: the cutoff date for this requirement, for any vendor group, is the project's plan filing date for Code Review on this project.

Manufacturer	Yes	No

_____
Signature

_____
Print Name

FORM SQA-1

Section 230548
Vibration Isolation and Seismic Restraints
Seismic Quality Assurance Plan for The Installation of Life Safety
And High Hazard Systems (Inspections)

Contractor Name: _____

Date: _____

Project: _____

Specification Section: _____

The following are required for the Seismic Quality Assurance Installation Plan for Life Safety and High Hazard systems to be prepared and submitted by each installing contractor. This plan must reflect all of the provisions and reports outlined in the paragraphs below. As part of this contractor's final requisition, this form must accompany, along with all satisfactorily completed tests and reports, the final payments request including all applicable certification reports.

- Special field inspection and testing is required by IBC Chapter 17 during the installation of Life Safety and High Hazard System components including equipment, piping and all electrical connections. Components must be inspected by a Building Official or approved independent special inspector periodically during the course of installation. Contractor shall submit such inspection reports as part of his project wrap up for each group of equipment, components so requiring this program. All components, which are Life Safety designate or Handle Hazardous substances fall into this category. Typical Life Safety and High Hazard components as well as non-life safety components listed in that section, are outlined in PART 1 of the 230548 Specification.

_____
Signature

_____
Print Name

END OF SECTION 260548

SECTION 262415 - DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 01 Specification Sections apply to work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide distribution panelboards as shown on the Drawings and as specified herein.

1.3 QUALITY ASSURANCE

A. Basis of Design: Siemens Energy and Automation

B. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Square D Company
2. Eaton Corporation: Cutler-Hammer Products

C. Substitutions not permitted.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Manufacturer's literature and illustrations.
2. Manufacturer's specification and engineering data:

a) Materials.
b) Parts.
c) Devices.
d) Accessories.

B. Contract Closeout Submittals:

1. Record drawings
2. Panelboard schedules (8-1/2" X 11")
3. Product warranty for panelboards.

C. Manufacturer Seismic Qualification Certification: Submit certification that distribution panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration Isolation and Seismic Restraints for Electrical Systems". Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Refer to Division 01 specifications for additional requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. All distribution panelboards for the project shall be of the same manufacturer, factory assembled, and provided with the number of protective devices indicated on Drawings.

2.2 PANELBOARD

A. Phase and neutral busses shall be copper unless otherwise noted on Drawings

B. Protective Devices: Circuit breakers or switch and fuse units shall be bolted on with trip, frame, and poles as indicated.

C. Panels shall be fully rated for the AIC rating listed – no series rating.

D. Multi-pole circuit breakers shall have a common integral trip mechanism and be of single, molded-case design of frame, trip, and short-circuit rating, as indicated on Drawings.

E. Factory-installed, high-compression, bolt-on cable connectors shall be provided for all panel service lugs and all protective devices over 100 amps in capacity, for aluminum cable only. If copper cable is used standard mechanical "AL/CU" lugs can be provided for branch devices only. See "Wire and Cable" section of this Specification for connector specifications.

F. All multi-section distribution panelboards shall be bus connected together. Bus shall be sized to amp capacity of unit

G. Where provisions only are indicated, all necessary provisions including bus bars shall be provided for the future installation of protective devices.

2.3 CABINETS

A. All trims and doors shall have baked-on gray lacquer or enamel finish.

1. Trims and doors shall be constructed of code gauge steel, complete with all bracing, clamps, supports and locks for the installation of the panelboard.

2. Panelboard cover/door assembly shall be hinged "door-in-door" construction

B. Back boxes shall be constructed of code gauge steel and have hot-dipped galvanized finish.

2.4 DIRECTORY CARDS

A. Provide metal card frame with transparent plastic cover located on back of panel door.

B. Cards shall be neatly typed, stating circuit number and item controlled, and location by level, room number, or name and/or column indication.

2.5 NAMEPLATES

A. Identify all panelboards and branch circuit devices with engraved nameplates to correspond with power riser diagram.

B. Provide engraved black phenolic plate with white letters not less than 3/8-inch high in block-letter style.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Installer shall examine conditions under which panelboards are to be installed and notify Architect/Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and the Architect/Engineer.

B. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Check to see that all distribution panelboards are correct for the project.

E. Coordinate conduit rough-in for distribution panelboards.

3.1 CONNECTION

A. Connect conduits and wireways to distribution panelboards.

3.2 INSTALLATION

A. Mount all surface-mounted panels on a steel frame of 12- gauge, hot-dipped, galvanized steel channel with a cross-section dimension of at least 1-1/2 inches by 1-1/2 inches.

1. Design frame to distribute weight evenly.
2. Secure to floor and ceiling slab at drywall partitions. Partitions are not to support channels.
3. Secure to floor and wall at masonry partitions.

B. Install all floor-mounted distribution panelboards on 4-inch concrete pad extending 4 inches beyond front and sides of equipment.

C. Coordinate conduit rough-in for panelboards.

3.3 CLEANING

A. Clean all dirt and debris from the inside and outside of panelboards.

END OF SECTION 262415

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide the wiring devices shown on the Drawings and as specified.

1.3 QUALITY ASSURANCE

A. Basis of Design: Hubbell Wiring Device-Kellems or as specified in Part 2 of this Section.

B. All devices shall be specification grade minimum unless otherwise noted.

C. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Hubbell Wiring Device-Kellems
2. Leviton
3. Legrand - Pass and Seymour
4. Eaton - Arrow Hart
5. Lutron
6. Legrand - Wattstopper
7. Sensor Switch

D. Substitutions are not permitted.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Manufacturer's literature, illustrations, and specifications
2. Two samples of each specified device.

B. Contract Closeout Submittals:

1. Product warranty for electrical devices.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. General: Provide wiring device with cover plate for all devices as indicated on Drawings.

Switches:

1. Single-pole, 20-amp, 120/277-volt toggle switches, Hubbell Wiring Device-Kellems, Catalog No. 1221*(* - color by architect).
2. Double-pole, 20-amp, 120/277-volt toggle switches, Hubbell Wiring Device-Kellems, Catalog No. 1222*(* - color by architect).
3. Three-way, 20-amp, 120/277-volt toggle switches, Hubbell Wiring Device-Kellems, Catalog No. 1223*(* - color by architect).
4. Four-way, 20-amp, 120/277-volt toggle switches, Hubbell Wiring Device-Kellems, Catalog No. 1224*(* - color by architect).
5. One-pole, 20-amp, 120/277-volt toggle switch with pilot light, Hubbell Wiring Device-Kellems , Catalog No. HBL1221*PL (* - color by Architect).
6. Three-way, 20-amp, 120/277-volt toggle switch with pilot light, Hubbell Wiring Device-Kellems, Catalog No. HBL1223*PL (* - color by Architect).
7. Decorator one-pole, 20-amp, 120/277-volt toggle switch, Hubbell Wiring Device-Kellems, Catalog No. DS120* (* - color by Architect).
8. Decorator two-pole, 20-amp, 120/277-volt toggle switch, Hubbell Wiring Device-Kellems, Catalog No. DS220* (* - color by Architect).
9. Decorator three-way, 20-amp, 120/277-volt toggle switch, Hubbell Wiring Device-Kellems, Catalog No. DS320* (* - color by Architect).
10. Decorator four-way, 20-amp, 120/277-volt toggle switch, Hubbell Wiring Device-Kellems, Catalog No. DS420* (* - color by Architect).

Receptacles:

1. Two-pole, three-wire, 20-amp, 125-volt duplex grounding-type receptacle, Hubbell Wiring Device-Kellems, Catalog No. 5362* (*color by Architect)
2. Two-pole, three-wire, 20-amp 125-volt duplex Controlled receptacle, Hubbell Wiring Device-Kellems, Catalog No. BR20C* (*color by Architect).
3. Two-pole, three-wire, 20-amp 125-volt duplex receptacle with ground fault interrupter, Hubbell Wiring Device-Kellems, Catalog No. GF20*LA (*color by Architect).
4. Decorator two-pole, three-wire, 20 amp, 125 volt duplex grounding type receptacle, Hubbell Wiring Device-Kellems, Cat. No. DR20* (color by Architect).
5. Decorator two-pole, three-wire, 20-amp 125-volt duplex Controlled receptacle, Hubbell Wiring Device-Kellems, Catalog No. DR20C* (*color by Architect).
6. Two-pole, three-wire, 20-amp, 125 volt isolated ground, Surge Protective Device (SPD) duplex receptacle, Hubbell Wiring Device-Kellems, Cat. No. IG5362S* (*color by Architect).
7. Two-pole, three-wire, 20-amp, 125-volt tamper-resistant duplex grounding-type receptacle, Hubbell Wiring Device-Kellems, Catalog No. BR20TR* (color by Architect)
8. In dwelling units only, Contractor may provide two-pole, three-wire, 15-amp 125-volt duplex grounding-type receptacle, Hubbell "Home Select" Cat. No. RR15S (color by Architect)
9. In dwelling units only, Contractor shall provide two-pole, three-wire, 15-amp 125-volt, tamper-resistant, duplex grounding, arc fault protection type receptacle with LED indicator, Hubbell Wiring Device-Kellems, Cat. No. LEDAFR15* (color by Architec
10. Two-pole, three-wire, 20 amp, 125-volt, tamper-resistant, duplex grounding, arc fault protection type receptacle with LED indicator, Hubbell Wiring Device-Kellems, Cat. No.

LEDAFR20*(color by Architect)

11. In dwelling units only, Contractor may provide two-pole, three wire, 15-amp , 125-volt, tamper-resistant, USB combination charging 3 amp, 5 volt dc dual ports, stainless steel grade 304 USB ports, rated for 10,000 cord insertions and removals, duplex decorator style. Complies with battery charging specification USB BC1.2 and listed to UL498 and 1310. Hubbell Wiring Device-Kellems, Cat. N0. USB15X2*(*color by architect)
12. Two-pole, three wire, 20-amp, 125-volt, tamper-resistant, USB combination charging 3 amp, 5 volt dc dual ports, stainless steel grade 304 USB ports, rated for 10,000 cord insertions and removals, duplex decorator style. Complies with battery charging specification USB BC1.2 and listed to UL498 and 1310. Hubbell Wiring Device-Kellems, Cat. No. USB20X2*(*color by architect)

B. Other devices shall be as indicated on the Drawings.

C. Cover plates:

1. All device plates used on the project shall be the same manufacturer as the device installed.
2. Device plate material and color shall be selected by the Architect.
3. Where gang combinations are required, the combinations shall be provided as single plate.
4. Where indicated on the Drawing, device plates are to be engraved, and letters shall be 3/16-inch block style with red fill.

Weatherproof cover plates:

1. Extra Duty Rated in-use weatherproof cover plates shall be provided for all outlets exposed to the weather, in wet locations or as indicated on the drawings.

   a. Provide Pass and Seymour, Inc. Catalog No. WIUC10-*(* - color by architect).

D. Mounting Heights:

1. Mounting heights of wall outlets shall be measured from the finished floor to the center of the outlet. Unless indicated or specified otherwise, the mounting heights of outlets or devices shall be as indicated on the Architectural drawings.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check to see that wiring device is correct for equipment being used with outlet. All outlets are to be mounted straight and plumb with wall.

3.2 INSTALLATION

A. Install wiring devices and cover plates for all devices indicated on Drawings. Screws to attach receptacles, switches and covers to outlet boxes shall be the screws provided with the device or the screws must match the thread gauge or size of the screw-mounting openings. Unsuitable means of attachment such as drywall screws is unacceptable.

B. Install tamper-resistant receptacles in dwelling units, guest rooms, guest suites, child care facilities and where indicated on Drawings.

C. Install ground fault type receptacles in accessible areas for all outlets in toilet rooms, coffee areas, kitchen areas, dwelling laundry areas, commercial repair garages, vending machines where required, janitor areas and outside locations and as indicated on Drawings. Provide weatherproof "Extra Duty" in-use covers for all receptacles located in wet locations.

D. In dwellings install arc-fault circuit-interrupter type receptacles in all bedrooms, recreation rooms, sunrooms, laundry areas, dining rooms, closets, dens, kitchens, family rooms, hallways, libraries, living rooms, parlors and similar areas or rooms in accessible areas.

E. Install controlled receptacles with appropriate symbol for automatically powered on and off function as indicated on drawings.

F. Snap switches used in two-circuit and three-circuit installations shall be listed and marked as suitable for the installation.

G. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions. Do not exceed the load rating of dimmer after derating.

H. Occupancy Sensors:

1. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (9 to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

2. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

J. All devices shall be loop wired around the device screw terminals per the Manufacturer's instructions – push-in terminals shall not be used

K. Remove wall plates and protect devices and assemblies during painting.

3.3 CONNECTION

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Wire and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 01 Specification Sections apply to work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide fuses as shown on the Drawings and as specified herein.

1.3 QUALITY ASSURANCE

A. Basis of Design: Bussmann

B. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Chase-Shawmut
2. Reliance Fuse
3. Little Fuse Co.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Manufacturer's literature and illustrations.
2. Manufacturer's specifications and engineering data.
3. Fuse schedule identifying class, type and size, and equipment/device/system protected for each specific location.

B. Contract Closeout Submittals:

1. Record fuse schedule
2. Product warranty for fuses

C. Refer to Division 01 specifications for additional requirements.

PART 2 - PRODUCTS

2.1 FUSES

A. General: Provide one complete set of fuses for all safety switches, switchboards, panelboard, and motor control center requiring fuses.

1. Fuses:

a) Fuses 0 to 600 amps shall be Bussmann Manufacturing Company, Class "J".
b) Fuses 601 amps and up shall be Bussmann Manufacturing Company, Class "L

c) Fuses for motor protection shall be Bussmann Manufacturing Company, Class "RK-1".

B. Provide cabinet and one set of three fuses for each size fuse used on the project. The fuses are to be delivered to Owner at project's completion properly identified as to where the sets of fuses may be used.

C. Fuses for entire project shall be from same manufacturer.

D. Current limiting fuses shall be selected to reduce the availability fault current to a value less than the withstand rating of the equipment served and less than the interrupting capacity of the circuit protective device. The fuse manufacturer shall submit fuse characteristic curves of peak demand through current versus short circuit current in symmetrical RMS amperes.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check to see that fuses are the proper type, class, amperage, and voltage for the project.

3.2 INSTALLATION

A. Install fuses of proper-type voltage and amperage in devices requiring fuses, insuring fuses are set up properly in jaws of equipment.

B. Install fuses of proper-type voltage and amperage in all motor control centers; coordinate with motor manufacturer requirements.

C. Verify that each set of fuses in a device (i.e., disconnect, switchboard fused switch, etc.) are the same type and manufacturer.

END OF SECTION 262813

SECTION 262816 - SAFETY DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions Division 01 Specification Sections apply to work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide the safety switches as shown on the Drawings and as specified herein.

1.3 QUALITY ASSURANCE

A. Basis of Design: Siemens

B. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Eaton Corporation: Cutler-Hammer Products
2. Square D Company

C. Substitutions are not permitted.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Manufacturer's literature and illustrations.
2. Manufacturer's specifications and engineering data.

a) Materials
b) Parts
c) Devices

B. Quality Control Submittals:

1. Shop layout drawings
2. Assembly details

C. Contract Closeout Submittals:

1. Record drawings
2. Product warranty for disconnect switches

D. Refer to Division 01 specifications for additional requirements.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. General: Provide safety switches at all locations indicated on the Drawings and where required by code whether indicated or not.

B. Safety Switches:

1. Provide heavy-duty safety switches for all 3-phase and single phase applications.
2. Safety switches protecting motor feeders shall be "horsepower rated."
3. Safety switches shall have voltage rating suitable for their applications. Switches shall be either fused or non-fused with the number of poles indicated on the Drawings.
4. Safety switches fed by four conductors shall be supplied with solid neutral block.
5. All safety switches shall have provisions for pad locking.

C. Enclosures:

1. Provide NEMA Type 1 enclosures for normally dry locations and NEMA Type 4X enclosure for normally wet locations. All enclosures shall have provisions for padlocking operating handle in the open position.
2. Provide baked-on gray lacquer or enamel finish on all enclosures.
3. Provide black phenolic nameplates with engraved white letters not less than 3/8-inch high block style on doors to identify item controlled.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Installer shall examine conditions under which safety switches are to be installed and notify Architect/Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and the Architect/Engineer.

B. Check to see that the safety switch is correct for the project.

C. Coordinate conduit rough-in for safety disconnect switches.

3.2 INSTALLATION

A. Install all safety switches where indicated on Drawings.

B. Provide a steel framework which shall provide a minimum one-inch air space between equipment and wall. Frames may be secured to masonry walls but not to drywall partitions.

C. Coordinate safety switch locations with mechanical contractor in order to verify proper clearances in front of and above each switch prior to installation.

3.3 CONNECTION

A. Connect conduit to safety switches.

B. Connect conductors to safety switches.

3.4 CLEANING

A. Clean all dirt and debris from the inside and outside of the safety switches.

END OF SECTION 262816

SECTION 265000 - LIGHTING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. Provide lighting fixtures, lamps, and accessory equipment as shown on the drawings and verify the exact type of ceiling being provided for the project in writing with Architect, and coordinate with fixture supplier to ensure proper installation as specified herein.

1.3 QUALITY ASSURANCE

A. Basis of Design: As indicated on the Drawings.

B. Acceptable Manufacturers: If it complies with these specifications, products by the following manufacturers will be acceptable.

1. Incandescent Fixtures: Genlyte, Omega and Lithonia or as scheduled on drawings.
2. Fluorescent Fixtures: Day Brite, Metalux, Lithonia and Genlyte or as scheduled on drawings.
3. LED Fixtures: (as indicated)
4. Exit Fixtures: Emergi-Lite and Lithonia or as scheduled on drawings.

C. Substitution for specified lighting fixtures will be considered only after award of contract for a 30 day period only.

1. Proposed substitutions will be accompanied by a statement setting forth any variation in contract price, should the substitution be permitted. Each proposed substitution listed will be accompanied by its ETL photometric distribution curve, coefficient of utilization, and other required data. Within seven days after the submittal, the Contractor will be prepared to submit one sample unit of each proposed substitute item accompanied with a sample of the specified item. Samples will include proper lamps, accessories, cord, and plug for operation on 120V. Failure to comply with these requirements will require the Contractor to supply the specified item only.

1.4 SUBMITTALS

A. Product Data Submittals:

1. Manufacturer's literature and illustrations including photometric data.
2. Point-by-point plots for all outdoor lighting; provide plots at 10'-0" x 10'-0" center scale.

B. Contract Closeout Submittals:

1. Operating and Maintenance Manual with the following data:

a. Product data submittals

b. Wiring diagrams (as required)
c. Installation instructions (for other than lay-in type fixtures)
d. Parts lists

2. Manuals

3. Manufacturer Seismic Qualification Certification: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration Isolation and Seismic Restraints for Electrical Systems". Include the following:

a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

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."

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Product warranty for fixtures.

PART 2 - PRODUCTS

2.1 GENERAL

A. Accessory equipment, such as starters, drivers, sockets, lamp holders, etc., will be approved by Underwriters Laboratories, Inc. (UL) and the Electrical Testing Laboratories (ETL), unless otherwise noted.

B. Lighting fixtures will be provided with the proper type of lamp and lamp holder. When incandescent fixtures are designed for larger lamps than the lamps specified to be furnished, suitable factory-installed socket extensions or socket stilts will be provided. Where possible, all incandescent lamps will be 130-volt, rough-service type.

C. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side. Dimmable LED fixtures shall have either a 01-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver.

2.2 LAMPS

A. Provide lamps for all fixtures on project conforming to the following requirements unless otherwise indicated in the "Lighting Fixture Schedule or Notes" on the drawings.

1. Fluorescent lamps for 36", 48", and U-tube lamps will be rapid-start T8 lamps which produce a 3500°K color. PL fluorescent 2700°K.

2. LED lamps will be 3500° K color unless otherwise noted, a minimum CRI of 80 and minimum lumen maintenance L70 rating of 50,000 hours.
3. Metal halide lamps will have wattage as shown on the drawings and will be phosphor-coated lamps.
4. High-pressure sodium lamps will have wattage as shown on the drawings and will be color-improved lamps with diffuse coating.
5. All incandescent lamps will be inside frosted and rated for 130 volts rough or extended service.

2.3 LAMP HOLDERS

A. Lamp sockets will be rigidly and securely attached to fixture enclosure or husk.

1. Incandescent and metallic vapor lamp sockets will be of the heavy-duty, heat-resistant, porcelain type.
2. Plastic or metal sheet sockets will not be used unless specified.
3. Fluorescent lamp sockets operating with an open circuit voltage in excess of 300 volts will be of the safety type and will open the supply circuit when the lamp is removed from the sockets.

2.4 DRIVERS

A. Power supply units including drivers shall meet the following requirements.

1. Electronic type labeled as RFI compliant
2. Sound rating of "A"
3. Minimum efficiency of 85%
4. Rated for operation between -40° degree C to +50° C
5. Capable of 120 to 480 (±10%) input voltage, single phase as required
6. Drivers shall have a power factor of $\geq$ 0.90
7. Drivers shall have a total harmonic distortion of $\leq$ 20%
8. Dimmable drivers shall be 0-10V type capable of dimming without LED strobing or flicker across their full dimming range.

2.5 BALLASTS

A. Provide ballasts for all fluorescent and high-intensity discharge (H.I.D.) fixtures conforming to the following requirements, unless otherwise indicated on the drawings.

1. Whenever possible, provide two-lamp ballasts for fixtures with two fluorescent lamps or multiples of two lamps. Three-lamp ballasts for electronic ballasts may be provided.
2. All ballasts will meet or exceed UL and ANSI specifications with labels and/or symbols of approval by the UL and of certification by the CBM as tested by the ETL.

B. Fluorescent Fixture Ballasts:

1. Ballasts for all fluorescent fixtures will be solid state, electronic type high-power factor, lead or series-lead circulating, sound-rated "A," unless otherwise noted. Ballasts will be nominal 120 volts or 277 volts, according to the voltage indicated in the lighting fixture schedule on the drawings. It will be the responsibility of the Contractor to determine the proper ballast voltage for each fixture. The ballast case temperature will be limited to 80°C when installed in a maximum ambient temperature of 105°F. Ballasts will have in-

rush current not exceeding 3 amperes at 277 volts, THD <10%, ballast factor >92% and power factor >96%. Ballasts will not produce electronic interference with properly installed audio, video and/or computer equipment.

a. Ballasts will carry a 3-year full replacement warranty, including material and labor.

2. Ballasts for 15- or 20-watt fluorescent lamps will be trigger-start, Class "P". Minimum ballast starting temperature will be 50°F.

a. Ballasts for 15- or 20-watt fluorescent lamps used in unheated interior spaces or on exterior of building will be trigger-start, Class "P", and 0°F minimum starting temperature. Use universal-type, very low heat (VLH) or equal where available.

3. Ballasts for 25-watt T8 fluorescent lamps will be solid state, Class "P", CBM certified, 50°F minimum starting temperature. Ballasts will be rated for 430 M.A. operation.

4. Ballasts for 25-watt T8 fluorescent lamps used in unheated interior spaces or on exterior of building will be rapid-start, Class "P", 0°F minimum starting temperature. Ballasts for 32-watt T8 fluorescent lamps will be solid state, Class "P", CBM certified, 50°F minimum starting temperature. Ballasts will provide full light output (99 percent nominal or greater) suitable for 430 M.A. operation.

a. Ballasts for 32-watt T8 fluorescent lamps used in unheated interior spaces or on exterior of building will be rapid-start, Class "P", 0°F minimum starting temperature, 430 M.A. operation.

5. Ballasts for all fixtures using compact fluorescent lamps shall be high power factor or electronic type and will be provided with lamp fault interrupter to shut off power to ballasts if lamps fail.

C. High-Intensity Discharge (H.I.D.) Fixture Ballast:

1. Ballasts for all high-intensity discharge lamps will be high-power factor, constant-wattage, auto-regulated (CWA) type, unless otherwise indicated, conforming to latest ANSI standard. Ballasts will be designed to operate on the voltage indicated in lighting fixture schedule or on the drawings and will operate in a normal ambient temperature of 105°F, with a minimum starting temperature of -20°F.

a. The ballasts, including starting aid, must be protected against normal lamp failure modes.
b. The ballasts will be capable of operation with an open- or short-circuit condition without significant loss of ballast life.
c. Lamp voltage and wattage regulation spread will not exceed 5 percent for ±10 percent of fixture operating voltage.
d. High-pressure sodium (HPS) ballasts will have a solid-state ignitor/starter with an average life in the pulsing mode of 10,000 hours at an ignitor/starter case temperature of 75°C.

2.6 FINISHES

A. Fixture finishes will be applied in a manner that will assure a durable, wear-resistant surface.

1. Prior to finishing, all surfaces will be free from foreign materials, such as dirt, rust, oil, polishing compounds, and mold-release agents.
2. Exposed metal surfaces used in interior areas, except chromium-plated parts, will be given an even coat of high-grade methacrylate lacquer or transparent epoxy.
3. All castings and extrusions will be machined, sanded or similarly treated, and given a minimum of one coat of baked-on, clear methacrylate lacquer, unless a painted finish is specified.
4. Aluminum surfaces exposed to weather will receive a duronodic or polyester powder paint finish for corrosion resistance.
5. Where a black reveal is specified on any fixture, the reveal must be black from all normal viewing angles.
6. Fixtures that have painted lamp chambers will be a minimum of 88 percent reflective paint for all metal surfaces in this area.

2.7 HIGH-TEMPERATURE CUTOUTS

A. Where fixtures requiring high-temperature cutouts are installed in non-accessible ceilings or in other areas where they are required by the authority having jurisdiction, the Contractor will provide and install the devices as a part of the contract.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check to see that all lighting fixtures are correct for the project.

B. Coordinate installation of lighting fixtures with mechanical equipment, piping, flexible wiring system, and conduit rough-ins for lighting fixtures.

C. Coordinate all lighting fixtures with ceiling types. Verify ceiling with Architect's drawings and with manufacturer's installation details for ceilings in the area to where fixtures will be installed before ordering.

3.2 INSTALLATION

A. Installation of all lighting fixtures will be in an approved, workmanlike manner subject to the Architect's approval.

1. Surface-mounted fixtures will not have gaps between the fixture and attaching surface, except where required by code regulation. Continuous rows of fixtures will be installed as to provide perfect alignment.
2. Recessed fixtures will not have gaps between the fixture trim and adjacent surface. Where light leaks occur, suitable gaskets will be installed.
3. Recessed lighting fixtures installed in ceilings will be of the proper type for the type of ceiling being installed. Lighting fixtures will be supported by the ceiling grid system. Additional ceiling ties will be installed by the ceiling contractor at each corner of each lighting fixture to reinforce the ceiling system. It will be the responsibility of the electrical contractor to coordinate the installation with the ceiling contractor and to ensure that all lighting fixtures have been properly supported. Provide all necessary

hardware and accessories for a complete installation of fixtures to ceiling system.

a. Plaster frames furnished by the fixture manufacturer will be provided for all recessed lighting fixtures when installed in plaster or acoustical plaster frame materials, and installation will be included in the bid under this section of the specifications.

4. Surface-mounted lighting fixtures will be supported directly from the building structure and not from the ceiling grid system. Method of support will be in an approved manner with all thread rods, beam clamps, and pipe or Kindorf channel. Wire support and/or caddie clips will not be acceptable. The support assembly for each fixture will be capable of supporting 150 pounds indefinitely.

5. Through wiring of fluorescent fixtures through ballast compartments will not be permitted.

3.3 CONNECTION

A. Connect raceways or flexible wiring conductor to lighting fixtures.

3.4 CLEANING

A. Clean all dirt and debris from inside and outside of fixtures.

B. Clean all lenses, reflectors and louvers of dirt, labels, and fingerprints before final inspection.

END OF SECTION 265000