

**North Adams Regional Wastewater
Treatment Plant**

Village of Winchester, OH

**WPCLF Funded Project
&
USEPA Community Grants Program Funding**

July 2026

200619



4420 Cooper Rd., Ste 200 | Cincinnati | OH | 45242 |
513.791.1700 | www.verdantas.com

VILLAGE OF WINCHESTER OFFICIALS

ADMINISTRATION

Kenneth Shelton, Mayor

Jayne Eldridge, Finance Director

Mike Swackhammer, Street Superintendent

Christopher L. Moore, Village Attorney

COUNCIL

Barry Lung, President

Aaron Swackhammer

Jody Young

Joyce Porter

Kevin Carpenter

Brent Harper

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ADVERTISEMENT FOR BIDS/PUBLIC NOTICE TO BIDDERS

Sealed bids will be received by the Clerk's office at the Village of Winchester Town Hall, 24 W. Washington St., Winchester, OH 45697 until 2:00 p.m. August 18, 2026 and will be opened and read immediately thereafter for the

NORTH ADAMS REGIONAL WASTEWATER TREATMENT PLANT

WPCLF FUNDED PROJECT

&

USEPA COMMUNITY GRANTS PROGRAM FUNDING

OPINION OF PROBABLE CONSTRUCTION COST: \$6,750,000.00

COMPLETION DATE: 730 DAYS FROM NOTICE TO PROCEED

The bid specifications, drawings, plan holders list, addenda, and other bid information (**but not the bid forms**) may be viewed and/or downloaded for free via the internet at <https://bids.verdantas.com>. The bidder shall be responsible to check for Addenda and obtain same from the web site.

Bids must be in accordance with drawings and specifications and on forms available from Verdantas LLC at a non-refundable cost of One Hundred Seventy-Five and 00/100 Dollars (\$175.00) for hard copies **and Forty-Five Dollars (\$45.00) for electronic files**. Documents may be ordered by registering and paying online at <https://bids.verdantas.com>. Please contact planroom@verdantas.com or call (440) 530-2351 if you encounter any problems viewing, registering, or paying for the documents.

All bidders are required to attend a **Mandatory** Pre-Bid Conference on August 4, 2026 at 10:00 a.m. EDT at the Village of Winchester Town Hall, 24 W. Washington St., Winchester, OH 45697. Bidders may participate virtually via Microsoft Teams. Join via your computer or mobile app using this link: <https://teams.microsoft.com/meet/210833172014154?p=nTEraPc2pAnRO2UEEM>. Meeting ID: 210 833 172 014 154, Passcode: Gw3FD6i5. A site visit to the Winchester WWTP will follow. Failure to attend the Pre-bid Conference will subject the bidder's proposal to be considered non-responsive.

This project will be funded by the Water Pollution Control Loan Fund Program as administered by the Ohio Environmental Protection Agency and the Ohio Water Development Authority. The Contractor shall note that there are Disadvantaged Business Enterprise participation goals for this project.

This procurement is subject to the EPA policy on encouraging the participation of small business in rural areas (SBRAs).

Build America, Buy America Act (BABA) requirements for the USEPA Community Grants Program Funding.

Publish: *People's Defender*
July 22, 2026
July 29, 2026

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SECTION 1
BID DOCUMENTS

INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

- 1.1 Sealed bids shall be received by the Owner at the location specified and until the time and date specified in the Advertisement for Bids/Public Notice to Bidders.
- 1.2 Each bid shall contain the full name and address of each person or company interested in said bid. If no other person be so interested, the Bidder shall distinctly so state the fact.
- 1.3 Bid forms must be completed in ink or by typewriter. Any corrections to the bid forms prior to submission must be initialed by the person signing the bid. Failure to submit any bid form(s) or other required document(s) may be cause for rejection of the bidder's bid at the sole discretion of the Owner.
- 1.4 Bids by Corporations must be executed in the corporate name by the President, Vice President, or other officer accompanied by evidence of authority to sign and the corporate seal must be affixed and attested by the Secretary on the Corporate Resolution form.
- 1.5 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature.
- 1.6 All names must be typed or printed below the signature.
- 1.7 The bid shall contain an acknowledgment of receipt of all Addenda.
- 1.8 If a Bidder wishes to withdraw their bid prior to the opening of bids, they shall state their purpose in writing to the Owner before the time fixed for the opening, and when reached it shall be handed to them unread.
- 1.9 **After the opening of bids, no Bidder may withdraw his bid for a period of 120 days.**

PART 2 EXAMINATION OF CONTRACT DOCUMENTS AND SITE

- 2.1 Before submitting a bid, each Bidder must
 - A. Examine the Contract Documents thoroughly.
 - B. Visit the site to familiarize themselves with local conditions that may in any manner affect cost, progress, or performance of the work.
 - C. Familiarize themselves with Federal, State, and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress, or performance of the work.
 - D. Study and carefully correlate Bidder's observations with the Contract Documents.

- 2.2 Reference is made to the Specific Project Requirements for the identification of any reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the work which have been relied upon by the Engineer in preparing the drawings and specifications. Owner will make copies of such reports available to any Bidder requesting them if not made available with the bid documents. These reports are not guaranteed as to accuracy or completeness; nor are they part of the Contract Documents. Before submitting their bid each Bidder will, at their own expense, make such additional investigations and tests as the Bidder may deem necessary to determine their bid for performance of the work in accordance with the time, price and other terms and conditions of the Contract Documents.
- 2.3 Upon request, the Owner will provide each Bidder access to the site to conduct such reasonable investigations and tests as each Bidder deems necessary for submission for their bid.
- 2.4 The lands upon which the work is to be performed, rights-of-way for access thereto, and other lands designated for use by Bidder in performing the work are identified on the Drawings.
- 2.5 The submission of a bid will constitute an incontrovertible representation by the Bidder that they have complied with every requirement of this section and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the work.

PART 3 ESTIMATED QUANTITIES

- 3.1 In Unit Price Contracts, the quantities of the work itemized in the bid are approximate only and the bidders are hereby notified that the estimated quantities made by the Engineer are merely for the guidance of the Owner in comparing on a uniform basis all bids received for the work.
- 3.2 The contract quantities, where itemized, are based on plan horizontal and vertical dimensions unless otherwise specified. It is the Contractor's responsibility to verify and determine actual quantities of materials such as pipe, pavement, subgrade, etc. in their ordering materials.
- 3.3 Payments, except for lump sum contracts and except for lump sum items in unit price contracts, will be made to the Contractor only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications.
- 3.4 The successful Bidder will be required to furnish the Owner with a complete breakdown of the lump sum bid items, to the satisfaction of the Engineer/Architect, before signing the Contract documents.

PART 4 CONTRACTOR'S QUALIFICATION

- 4.1 Bidder shall provide detailed information relating to similar projects completed within the past 5 years which demonstrates the bidder's capability, responsibility, experience, skill, and financial standing to undertake this type of project and shall include a list of all projects currently under construction including status and contact person.
- 4.2 Bidder shall own, have rental or lease agreements for, or otherwise have readily available any and all equipment and tools necessary for proper execution of the work. The Owner reserves the right to request lists of equipment or tools available for the project including sources.
- 4.3 Bidder shall provide pertinent information to the Owner relative to any pending suits or outstanding liens. If no information is provided by the Bidder, the Owner shall assume that any such suits or liens do not exist.
- 4.4 The Owner may require similar information on any or all subcontractors proposed by the Bidder.
- 4.5 Bids of corporations not chartered in the state in which the work will take place must be accompanied by proper certification that the corporation is authorized to do business in that state.

PART 5 SUBCONTRACTORS

- 5.1 The Bidder shall state on the appropriate bid form the names of all Subcontractors, Sub Consultants and other professional service providers proposed and the items of work they are to be assigned. All work not assigned to a Subcontractor shall be assumed by the Owner to be performed by the Bidder.
- 5.2 The Owner reserves the right to approve all subcontractors proposed by the Bidder. If the Owner, after due investigation, rejects the use of a proposed subcontractor, the apparent successful Bidder may either submit an acceptable substitution without increase in bid price or decline substitution and withdraw their bid without sacrificing their bid security. Any listed subcontractor to whom the Owner does not make written objection prior to award of contract, shall be deemed acceptable to the Owner.
- 5.3 Requests for changes of Subcontractor by the Bidder after the award shall be subject to the Owner's approval and shall not change the contract bid prices.
- 5.4 No contractor shall be required to employ any Subcontractor, person or organization against whom they have reasonable objection.

PART 6 BID REVIEW BY OWNER

- 6.1 The Owner reserves the right to reject any and all bids, to waive as an informality any and all irregularities, and to disregard all nonconforming, nonresponsive or conditional bids.

- 6.2 All extensions and totals of unit prices and quantities submitted as part of the bid shall be considered informal until verified by the Owner. All bids must be made on the forms contained herein and the bid prices must be written therein, in figures only. Unit prices shall be separately written for "Unit Price Labor," "Unit Price Material," and "Total Unit Price" for each item listed. Should an error in addition and/or multiplication be determined while checking the Contractor's math and verifying their total bid, the "Unit Price Labor" and the "Unit Price Material" figures shall govern in determining the correct "Total Unit Price" and the correct "Item Total."
- 6.3 Each bidder must bid on all Items, Alternates, Deductions, and Additions contained in the Bidding Forms. All bids not in conformity with this notice may be considered non-responsive and may be rejected.
- 6.4 More than one bid for the same work from an individual or entity under the same of different names will not be considered. Reasonable grounds for believing that any bidder has an interest in more than one bid for the work may be cause for disqualification of that bidder and the rejection of all bids in which the bidder has an interest. A subcontractor or supplier is not a bidder, and may submit prices to multiple bidders.
- 6.5 In evaluating bids, the Owner may consider:
- A. The qualifications and experience of the Bidder, proposed subcontractors, and principal material suppliers as outlined in the plans and specifications.
 - B. Financial ability and soundness of the Bidder and proposed subcontractors.
 - C. Completeness of all bid forms and bid requirements.
 - D. Alternates and unit prices requested in the Bid Forms.
 - E. Unit prices or schedules of values that are or appear to be unbalanced.
 - F. Previous contractual experience with the Owner.
 - G. Whether or not the bid package complies with the prescribed requirements.
 - H. The proposed completion date, if applicable.
 - I. Any other matter allowed by law or local ordinance or resolution.
- 6.6 Owner may conduct further investigations as they deem necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications, and financial ability of the Bidder, proposed Subcontractors, and other persons and organizations to do the work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.
- 6.7 Owner reserves the right to reject the bid of any Bidder who does not pass any such evaluation to Owner's satisfaction.

- 6.8 The Contract award shall be based on the lowest and best bid or lowest responsive and responsible bid (as applicable for the public contracting agency receiving bids) for the base bid and selected alternate items (if any) for this project.

PART 7 BID SECURITY

- 7.1 Each bid must be accompanied by a certified or cashier's check in the amount of 10% of the amount bid, an irrevocable letter of credit in the amount of 10% of the amount bid or an original bond in the amount of 100% of the amount bid per O.R.C. Sections 153.54 and 153.571. The certified or cashier's check, or irrevocable letter of credit shall be from a financial institution authorized to transact business in the State of Ohio and acceptable to the Owner. The bond shall be underwritten by a Surety Company authorized to transact business in the State of Ohio having an Ohio agent and listed on the most current Department of the Treasury Circular 570, "Surety Companies Acceptable on Federal Bonds." The bond shall be a "Bid Guarantee and Contract Bond" ("rollover bond") per O.R.C. Sections 153.54 and 153.571 submitted for the full amount of the bid **including all alternates**, if any.

If bid security is made by bond, the Bidder and their Surety shall sign the Supplemental Bond Acknowledgement form and submit with their bid.

- 7.2 The certified or cashier's check, irrevocable letter of credit, or bond shall be made payable to the Owner and shall serve as a guarantee that in the event the bid is accepted and a contract is awarded to the successful Bidder, the contract will be executed by the bidder including any certifications, certificates or additional bonds required by the contract.
- 7.3 Failure on the part of the successful Bidder to execute the contract documents will cause the certified or cashier's check, irrevocable letter of credit, or bond to be forfeited to the Owner as damages.
- A. If the Owner awards the contract without rebidding, the Bidder (and the Surety on their bond if a bond was submitted) shall be liable to the Owner for a penal sum not to exceed the difference between the low bid and the next lowest bidder or 10% of the amount of the bid, whichever is less.
- B. If the Owner does not award the Contract to the next lowest Bidder, but resubmits the project for bidding; the Bidder (and the Surety on their bond if a bond was submitted) shall be liable to the Owner for a penal sum not to exceed the costs in connection with the resubmission of bids or 10% of the amount of the bid, whichever is less.
- 7.4 Checks or letters of credit for bid security of all bidders will be returned in the manner and timeframe stipulated in the O.R.C. Section 153.54 Bid guaranty to be filed with bid.

PART 8 CONTRACT BOND

- 8.1 As security for faithful performance and payment of all obligations under the Contract, the Owner shall require and the successful Bidder shall furnish either:
- A. *If submitted as Bid Security at time of bid:* "Bid Guarantee and Contract Bond" (AKA "rollover bond") per O.R.C. Sections 153.54 and 153.571.
 - B. *If a cashier's check or irrevocable letter of credit is submitted as Bid Security at time of bid:* Contract Bond per O.R.C. Sections 153.54 and 153.57, in the amount of 100% of the Contract Price. The Contractor and their Surety shall sign the Supplemental Bond Acknowledgement form and submit with the Contract forms
- 8.2 The bond shall be underwritten by a Surety Company authorized to transact business in the State of Ohio having an Ohio agent and listed on the most current Department of the Treasury Circular 570, "Surety Companies Acceptable on Federal Bonds."
- 8.3 The contract bond shall cover correction of the work for the period stated in the specifications and the correction period shall start upon Final Acceptance of the entire project and final payment by the Owner.
- 8.4 Nothing in the performance of the Engineer's service to the Owner in connection with this project shall in any way imply any undertaking for the benefit of the successful Bidder, its subcontractor(s), or the surety of any of them.

PART 9 AWARD AND EXECUTION OF CONTRACT

- 9.1 After the Owner's legislative body awards the project, the successful bidder will receive the unsigned contract documents. Within 10 days after their receipt, the successful Bidder shall sign and deliver to the Owner said contract documents including any certifications, certificates, or additional bonds required by the contract.
- 9.2 The Owner shall execute the Contract within 120 days after the day of the bid opening. When necessary and by mutual consent between the Owner and the Successful Bidder, this 120-day period may be extended.**
- 9.2 The date of the Owner's signature on the Contract Agreement shall be the effective contract date.
- 9.3 The Owner shall execute and deliver to the successful Bidder one set of fully executed contract documents.

PART 10 INSURANCE

- 10.1 Verification of limits for public liability, property damage, automobile, Worker's Compensation, or any other insurance required by the provisions of this Contract must be submitted to the Owner prior to execution of the Contract.
- 10.2 All insurance shall be endorsed so that it cannot be cancelled for non-payment of premium for 10 days or cancelled or non-renewed for any other reason in less than 30

days after a written notice of such proposed action by the insurer is given to the Owner. The cancellation clause on the Certificate(s) of Insurance shall read as specified in the Supplementary Conditions and failure to submit an insurance certificate and/or policy endorsement verifying same shall be reason for the Owner to consider the Contractor non-responsive in complying with the requirements for contract execution and may be cause for forfeiture of the Bid Security to Owner.

- 10.3 The Insurer's affording coverage shall be authorized to transact business in the State of Ohio and be listed on the most current Ohio Department of Insurance list of Ohio Licensed Companies.
- 10.4 The Contractor's Liability Insurance policy(s) shall be endorsed such that limits are on a Per Project basis.
- 10.5 The Contractor shall also provide an Owner's and Contractor's Protective Policy.

PART 11 NON-COLLUSION AFFIDAVIT

- 11.1 Collusion between bidders will be cause for rejection of affected bids and may be cause for rejection of all bids. Multiple bids submitted by one bidder under the same name or different names, whether as an individual, firm, partnership, corporation, profit or non-profit, affiliate, or association will be cause for rejection of bids. A subcontractor is not a bidder, and may submit prices to multiple bidders.
- 11.2 All bidders shall submit an affidavit that their bid is genuine and not collusive or sham; that such bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidder or person, to put in a sham bid, or that such other bidder or person shall refrain from bidding; that such bidder has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against the Owner or any person or persons interested in the proposed contract; that such bidder is the only party (or parties) who has an interest with the bidder in the profits of any contract which may result from the herein contained proposal; that no individual affiliated with the Owner, including but not limited to the head of any department, any employee, or any other official or officer of the Owner, is or will be directly or indirectly interested in this bid, and/or the profits from this bid if successful; that no individual affiliated with the Owner, including but not limited to the head of any department, any employee, or any other official or officer of the Owner, has or will receive anything of value as a result of the submission of this bid or its award; that no individual affiliated with the Owner, including but not limited to the head of any department, any employee, or any other official or officer of the Owner, has been solicited to provide assistance and/or provided assistance to the bidder which might give the bidder a competitive advantage or circumvent the competitive bidding process; and that all statements contained in said proposal are true; and further, that such bidder has not, directly or indirectly submitted this bid, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

- 11.3 Each bid must be accompanied by a completed Noncollusion Affidavit provided within the contract documents.
- 11.4 Where there is reason to believe collusion or combination among bidders exists, the Owner reserves the right to reject the bid of those concerned.

PART 12 DELINQUENT PERSONAL PROPERTY STATEMENT

- 12.1 Included with the contract documents is a Delinquent Personal Property Statement to be filled out by the successful Bidder.
- 12.2 The statement shall be sent to both the County Auditor and the County Treasurer. A signed copy shall remain in the contract documents as well.

PART 13 ORIGINAL DOCUMENTS

- 13.1 All bid forms, contract forms, bonds and any other bid documents or contract documents requiring signatures shall be submitted with original signatures. No photo copies or faxed copies of signed documents shall be accepted.

PART 14 ADDENDA

- 14.1 The bidder shall be responsible to obtain Addenda from the web at <https://bids.verdantas.com>.

END OF SECTION 01/28/26

TITLE 18, U.S.C. , SECTION 874

KICKBACKS FROM PUBLIC WORKS EMPLOYEES

Whoever, by force, intimidation, or threat of procuring dismissal from employment, or by any other manner whatsoever induces any person employed in the construction, prosecution, completion or repair of any public building, public work, or building or work financed in whole or in part by loans or grants from the United States, to give up any part of the compensation to which he is entitled under his contract of employment, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 18, 2022

M-22-11

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Shalanda D. Young
Director

SUBJECT: Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure

On November 15, 2021, President Biden signed into law the Infrastructure Investment and Jobs Act (“IIJA”), Pub. L. No. 117-58, which includes the Build America, Buy America Act (“the Act”). Pub. L. No. 117-58, §§ 70901-52. The Act strengthens Made in America Laws¹ and will bolster America’s industrial base, protect national security, and support high-paying jobs. The Act requires that no later than May 14, 2022—180 days after the enactment of the IIJA—the head of each covered Federal agency² shall ensure that “none of the funds made available for a Federal financial assistance program for infrastructure, including each deficient program, may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.”³

The Act affirms, consistent with Executive Order 14005, *Ensuring the Future Is Made in All of America by All of America’s Workers* (“the Executive Order”), this Administration’s priority to “use terms and conditions of Federal financial assistance awards to maximize the use of goods, products, and materials produced in, and services offered in, the United States.”⁴

The Act provides statutory authorities for the Made in America Office (“MIAO”) in the Office of Management and Budget (“OMB”) to maximize and enforce compliance with Made in

¹ “Made in America Laws” means all statutes, regulations, rules, and Executive Orders relating to Federal financial assistance awards or Federal procurement, including those that refer to “Buy America” or “Buy American,” that require, or provide a preference for, the purchase or acquisition of goods, products, or materials produced in the United States, including iron, steel, and manufactured products offered in the United States. Made in America Laws include laws requiring domestic preference for maritime transport, including the Merchant Marine Act of 1920 (Pub. L. No. 66-261), also known as the Jones Act. Exec. Order No. 14,005, 86 Fed. Reg. 7475, § 2(b) (Jan. 28, 2021), *available at* <https://www.federalregister.gov/documents/2021/01/28/2021-02038/ensuring-the-future-is-made-in-all-of-america-by-all-of-americas-workers>. Made in America Laws also include laws that give preference to Indian-owned and -controlled businesses, such as the Buy Indian Act (25 U.S.C. 47), that produce items in the United States.

² For the purposes of this guidance, the terms “Federal agency” and “agency” mean any authority of the United States that is an “agency” (as defined in section 3502 of title 44, United States Code), other than an independent regulatory agency (as defined in that section). IIJA, § 70912(3).

³ IIJA, § 70914(a).

⁴ Exec. Order No. 14,005 (see footnote 1).

America Laws.⁵ MIAO aims to increase reliance on domestic supply chains and reduce the need for waivers through a strategic process aimed at: achieving consistency across agencies; gathering data to support decision-making to make U.S. supply chains more resilient; bringing increased transparency to waivers in order to send clear demand signals to domestic producers; and concentrating efforts on changes that will have the greatest impact.⁶

This memorandum provides implementation guidance to Federal agencies on the application of: (1) a “Buy America” preference⁷ to Federal financial assistance programs for infrastructure; and (2) a transparent process to waive such a preference, when necessary. A Federal financial assistance program for infrastructure is any program under which an award may be issued for an infrastructure project, regardless of whether infrastructure is the primary purpose of the award. The term “project” means any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States.⁸

Agencies should determine how this guidance is best applied to their infrastructure programs and processes, and consult with OMB, as needed, on establishing criteria, processes, and procedures for applying a Buy America preference and issuing waivers. OMB may update or provide additional guidance, as appropriate, to further assist agencies in the implementation of a Buy America preference.

I. Application of a Buy America Preference

By May 14, 2022, agencies must ensure that all applicable programs comply with section 70914 of the Act, including by the incorporation of a Buy America preference in the terms and conditions of each award with an infrastructure project.⁹ The Act requires the following Buy America preference:

- (1) All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
- (2) All manufactured products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States, and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation.

⁵ IJA, § 70923(a) & (b)(1).

⁶ OMB Memorandum M-21-26, Increasing Opportunities for Domestic Sourcing and Reducing the Need for Waivers from Made in America Laws available at: <https://www.whitehouse.gov/wp-content/uploads/2020/11/M-21-06.pdf>

⁷ For the purposes of this guidance, a “Buy America” preference is a domestic content procurement preference as defined in IJA, § 70912(2).

⁸ IJA, § 70912 (5) & (7).

⁹ See Appendix I: Example of Award Term - Required Use of American Iron, Steel, Manufactured Products, and Construction Materials.

- (3) All construction materials are manufactured in the United States. This means that all manufacturing processes for the construction material occurred in the United States.^{10, 11}

II. Applicability to Federal Financial Assistance Programs

This guidance applies to all Federal financial assistance as defined in section 200.1 of title 2, Code of Federal Regulations¹²—whether or not funded through IIJA—where funds are appropriated or otherwise made available and used for a project for infrastructure. Federal financial assistance means assistance that non-Federal entities receive or administer in the form of grants, cooperative agreements, non-cash contributions or donations of property, direct assistance, loans, loan guarantees, and other types of financial assistance. The term “non-Federal entity” includes States, local governments, territories, Indian tribes, Institutions of Higher Education (IHE), and nonprofit organizations.¹³

For purposes of this guidance, for-profit organizations are not considered non-Federal entities. However, this guidance does not alter independent statutory authorities that agencies may have to include domestic content requirements in awards of Federal financial assistance issued to for-profit organizations.

Federal agencies are encouraged to consult with OMB if they are uncertain about the applicability of this guidance to any particular infrastructure program.

Before applying a Buy America preference to a covered program that will affect Tribal communities, Federal agencies should follow the consultation policies established through Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, and consistent with policies set forth in the Presidential Memorandum of January 26, 2021, on Tribal Consultation and Strengthening Nation-Nation Relationships. Federal agencies should commence consultation promptly.

This guidance does not apply to “expenditures for assistance authorized under section 402, 403, 404, 406, 408, or 502 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5170a, 5170b, 5170c, 5172, 5174, or 5192) relating to a major disaster or emergency declared by the President under section 401 or 501, respectively, of such Act (42 U.S.C. 5170, 5191) or pre and post disaster or emergency response expenditures.”¹⁴ “[P]re and post disaster or emergency response expenditures” consist of expenditures for financial assistance that are (1) authorized by statutes other than the Stafford Act, 42 U.S.C. §§ 5121 et seq., and (2) made in anticipation of or response to an event or events that qualify as an “emergency” or “major disaster” within the meaning of the Stafford Act, *id.* § 5122(1), (2). Awards made to support the construction or improvement of infrastructure to mitigate the damage that may be caused by a non-imminent future emergency or disaster, such as awards

¹⁰ IIJA, § 70912 (2) & (6)(B)(ii).

¹¹ See Section VIII. of this guidance for more information on construction materials.

¹² IIJA § 70912(4)(A)

¹³ See 2 C.F.R. § 200.1.

¹⁴ IIJA § 70912(4)(B)

made under FEMA's Flood Mitigation Assistance program,¹⁵ do not qualify as "pre and post disaster or emergency response expenditures."

Subawards should conform to the terms and conditions of the Federal award from which they flow.¹⁶

The IIJA's definition of "infrastructure" encompasses public infrastructure projects. Thus, the term "infrastructure" includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property.¹⁷ Agencies should treat structures, facilities, and equipment that generate, transport, and distribute energy - including electric vehicle (EV) charging - as infrastructure.

When determining if a program has infrastructure expenditures, Federal agencies should interpret the term "infrastructure" broadly and consider the definition provided above as illustrative and not exhaustive. When determining if a particular construction project of a type not listed in the definition above constitutes "infrastructure," agencies should consider whether the project will serve a public function, including whether the project is publicly owned and operated, privately operated on behalf of the public, or is a place of public accommodation, as opposed to a project that is privately owned and not open to the public. Projects with the former qualities have greater indicia of infrastructure, while projects with the latter quality have fewer. Projects consisting solely of the purchase, construction, or improvement of a private home for personal use, for example, would not constitute an infrastructure project. Federal agencies are strongly encouraged to consult with OMB when making such determinations.

Agencies should consult with MIAO regarding their readiness to apply the requirements of the Act to covered programs. Agencies with questions regarding the application of a Buy America preference to agency-specific programs, including questions about the possible use of waivers during adjustment periods as agencies work to implement the Act, are advised to reach out to MIAO for technical assistance and advice.

III. Consistency with International Agreements

Pursuant to section 70914(e) of the Act, this guidance must be applied in a manner consistent with the obligations of the United States under international agreements.

IV. Avoid Unnecessary Disruption

The Act makes clear that its preferences apply to a Federal financial assistance program for infrastructure only to the extent that a domestic content procurement preference as described

¹⁵ See 42 U.S.C. § 4104c.

¹⁶ 2 CFR 200.101 (b) (2)

¹⁷ IIJA, § 70912(5).

in section 70914 of the Act does not already apply to iron, steel, manufactured products, and construction materials.¹⁸ Agencies should consider whether existing domestic content requirements meet the standards in the Act, as described in this memorandum. Agencies must make necessary changes to come into compliance with the Act's requirements, while preserving policies and provisions that already meet or exceed the standards required by the Act. For example, a program in which the standards for iron and steel already meet the standards in the Act may nevertheless be required to adopt new standards for manufactured products and construction materials. Maintaining current policies where appropriate avoids unnecessary disruption to programs, or elements of programs, that already meet or exceed Build America, Buy America requirements.

V. Effective Date for Awards

Agencies must ensure that, starting on May 14, 2022, all Federal financial assistance programs for infrastructure comply with the requirements of section 70914 of the Act. Therefore, new awards made on or after May 14, 2022, must take appropriate steps to ensure financial assistance awards comply with these requirements, which may include appropriate terms and conditions¹⁹ incorporating a Buy America preference. Renewal awards and amendments obligating additional funds to existing awards that are executed on or after May 14, 2022, must also include a Buy America preference. This means that agencies must include a Buy America preference in awards issued on or after May 14, 2022, even if Notices of Funding Opportunities for those awards did not include a Buy America preference. In these cases, agencies may consider whether public interest waivers may be needed to avoid undue increases in the time and cost of a project. Similarly, public interest waivers may be needed for awards and amendments made on or after May 14, 2022, where budgets for purchase of covered materials have already been agreed upon (including if materials have been ordered and construction has begun). Consistent with the guidance provided below, agencies should issue waivers judiciously and clearly communicate to recipients the limitations and conditions of any such waivers.

VI. Articles, Materials, and Supplies for Infrastructure

A Buy America preference, as defined in section I of this guidance, only applies to the iron and steel, manufactured products, and construction materials used for the infrastructure project under an award. If an agency has determined that no funds from a particular award under a covered program will be used for infrastructure, a Buy America preference does not apply to that award. Similarly, for a covered program, a Buy America preference does not apply to non-infrastructure spending under an award that also includes a covered project. A Buy America preference applies to *an entire infrastructure project*, even if it is funded by both Federal and non-Federal funds under one or more awards.

A Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply

¹⁸ IIJA, § 70917(a) &(b).

¹⁹ See Appendix I: Example of Award Term - Required Use of American Iron, Steel, Manufactured Products, and Construction Materials for exemplary language.

to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of or permanently affixed to the structure.

For the purposes of this guidance, an article, material, or supply should only be classified into *one* of the following categories: (1) iron or steel; (2) a manufactured product; or (3) a construction material. For ease of administration, an article, material, or supply should not be considered to fall into multiple categories. Agencies should apply the iron and steel test to items that are predominantly iron or steel, unless another standard applies under law or regulation.

Any waivers from these requirements must be in writing and meet the requirements of section 70914(b).

VII. Issuing Buy America Waivers

Pursuant to Section 70914(c) of the Act, the head of a Federal agency may waive the application of a Buy America preference under an infrastructure program in any case in which the head of the Federal agency finds that—

- (1) applying the domestic content procurement preference would be inconsistent with the public interest (a “public interest waiver”);
- (2) types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality (a “nonavailability waiver”); or
- (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent (an “unreasonable cost waiver”).

Federal agencies are responsible for processing and approving all waivers, including waivers requested by recipients and on behalf of subrecipients. To the greatest extent practicable, waivers should be targeted to specific products and projects.²⁰

Before issuing a waiver, the head of the Federal agency must make publicly available on the agency’s website a detailed written explanation for the proposed determination to issue the waiver and provide at least 15 days for public comment on the proposed waiver.²¹ General applicability waivers are subject to a minimum 30-day public comment period.²² By April 29, 2022, agencies should provide the website address where they will be posting proposed waivers for public comment to MBX.OMB.MadeInAmerica@omb.eop.gov. Pursuant to sections 70914(c) and 70937 of the Act, the waiver must be cross-posted to a centralized waiver transparency website managed by GSA, [BuyAmerican.gov](https://www.buyamerican.gov),²³ no later than November 15, 2022.

²⁰ See Section VII of this guidance for information on waiver principles and criteria.

²¹ Executive Order, § 4(b)(i)(2); IJJA, § 70914(c); IJJA, § 70937 (note that “Buy American” as used in this section also refers to Buy America preferences, per IJJA, § 70932(1)).

²² IJJA § 70914(d)(2)(A)(ii). See Section VII of this guidance for information on general applicability waivers.

²³ [BuyAmerican.gov](https://www.buyamerican.gov) redirects to [MadeInAmerica.gov](https://www.madeinamerica.gov).

To minimize duplication and promote efficiency, MIAO and GSA will coordinate with agencies on the expansion of the existing website's functionality to display waivers for Federal financial assistance and provide further instructions to agencies as necessary.

Federal agencies are responsible for performing due diligence and approving or rejecting waivers consistent with the Act, this guidance, and any other applicable Buy America laws. Federal agencies should notify MIAO in advance of posting an award- or project-level proposed waiver for public comment. However, Federal agencies must consult with MIAO for proposed waivers with broader applicability (such as a general applicability waiver) before posting them for public comment. The purpose of the consultation is to identify any opportunities to structure the waiver in order to maximize the use of goods, products, and materials produced in the United States to the greatest extent possible consistent with law. Federal agencies should send proposed waivers for review to MBX.OMB.MIAwaivers@omb.eop.gov.

Federal agencies must submit to MIAO a proposed waiver for review after the public comment period has concluded. MIAO will review the proposed waiver to determine if it is consistent with applicable law and policy,²⁴ and will notify the Federal agency of its determination.

All waiver requests must include a detailed justification for the use of goods, products, or materials mined, produced, or manufactured outside the United States²⁵ and a certification that there was a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with potential suppliers.²⁶ In addition, at a minimum and to the greatest extent practicable, each proposed waiver submitted to MIAO should include the following information, as applicable:

- Waiver type (nonavailability, unreasonable cost, or public interest)
- Recipient name and Unique Entity Identifier (UEI)
- Federal awarding agency organizational information (e.g., Common Government-wide Accounting Classification (CGAC) Agency Code)
- Financial assistance listing name and number
- Federal financial assistance program name
- Federal Award Identification Number (FAIN) (if available)
- Federal financial assistance funding amount
- Total cost of infrastructure expenditures, including all Federal and non-Federal funds (to the extent known)
- Infrastructure project description and location (to the extent known)
- List of iron or steel item(s), manufactured products, and construction material(s) proposed to be excepted from Buy America requirements, including name, cost, country(ies) of origin (if known), and relevant PSC and NAICS code for each.
- A certification that the Federal official or assistance recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with the prime contractor.

²⁴ Executive Order, § 4(c).

²⁵ IIJA, § 70937(c)(2)(A).

²⁶ IIJA, § 70937(c)(2)(D).

- A statement of waiver justification, including a description of efforts made (e.g., market research, industry outreach), by the Federal awarding agency and, in the case of a project or award specific waiver, by the recipient, in an attempt to avoid the need for a waiver. Such a justification may cite, if applicable, the absence of any Buy America-compliant bids received in response to a solicitation.
- Anticipated impact if no waiver is issued.
- Any relevant comments received through the public comment period.

The purpose of the information is to ensure that the agency has adequate information to perform due diligence, that MIAO has sufficient information to determine whether the proposed waiver is consistent with law and policy, and that sufficient information is available for public review. Information provided for public review should help interested manufacturers gauge the demand for products for which agencies are considering waiving a Buy America preference.

To avoid a need for duplicative waiver requests from entities that receive funding for one infrastructure project through multiple Federal agencies, the Federal agency contributing the greatest amount of Federal funds for the project should be considered the “Cognizant Agency for Made in America” and should take responsibility for coordinating with the other Federal awarding agencies. Such coordination will provide uniform waiver criteria and adjudication processes, minimize duplicative efforts among Federal agencies, and reduce burdens on recipients. The Cognizant Agency for Made in America shall be responsible for consulting with the other Federal awarding agencies, publicizing the proposed joint waiver, and submitting the proposed joint waiver for review to MIAO.

a. Exceptions for Unforeseen and Exigent Circumstances

In limited situations where there is an urgent need in an unforeseen and exigent circumstance, agencies have the authority to waive the application of Buy America preferences without submitting the waiver for public comment and MIAO determination.²⁷ As an exception to the public transparency requirements of the Act, agencies should exercise that authority only when necessary. Further, to ensure MIAO can fulfill its role as a central and transparent source of Made in America waivers, an agency that issues a waiver without first seeking public comment and MIAO approval must, within 30 days of the waiver’s issuance, submit a report to MIAO explaining its reliance upon the “unforeseen and exigent circumstance” exception.²⁸ MIAO will provide further instructions to agencies on how to submit those reports. Although public posting and MIAO review may be waived in exigent circumstances, agencies remain responsible for performing due diligence appropriate to the circumstances, consistent with the principles and criteria in paragraphs VII(b) and (c) below.

²⁷ IIIA, § 70937(b)(2).

²⁸ This reporting process was established pursuant to Executive Order 14,005, § 4(d) and OMB Guidance on Improving the Transparency of Made in America Waivers available at: <https://www.whitehouse.gov/wp-content/uploads/2021/10/Guidance-Memo-Improving-the-Transparency-of-Made-in-America-Waivers.pdf>.

b. Waiver Principles and Criteria

To ensure they are scrupulously monitoring, enforcing, and complying with applicable Buy America Laws and minimizing the use of waivers,²⁹ agencies must apply standard criteria to determine whether to grant a waiver in a given circumstance. Agencies with existing criteria must review it for consistency with this guidance and update it as appropriate. All other agencies must establish criteria.

Agencies may reject or grant waivers in whole or in part. To the greatest extent practicable, waivers should be issued at the project level and be product-specific. Overly broad waivers undermine market signals designed to boost domestic supply chains, particularly for key articles, materials and supplies in critical supply chains (i.e., critical supply chains identified in Executive Order 14017, *America's Supply Chains*). When necessary, agencies may consider issuing a waiver that has applicability beyond a single project; however, agencies should always issue, construe, and apply waivers to ensure the maximum utilization of goods, products, and materials produced in the United States, consistent with applicable law. Federal agencies may consult with MIAO when establishing or modifying criteria for granting waivers. They may also work within the Made in America Council, a practice that will help to foster consistency across agencies to the greatest extent practical and appropriate, given agency and program missions.

Federal agencies should use the following principles before issuing a waiver of any type:

- **Time-limited:** In certain limited circumstances, a Federal agency may determine that a waiver should be constrained principally by a length of time, rather than by the specific projects to which it applies. Waivers of this type may be appropriate, for example, when an item that is “nonavailable” is widely used in projects funded by a particular program’s awards. When issuing such a waiver, the agency should identify a short, definite time frame (e.g., no more than one to two years) designed to ensure that, as domestic supply becomes available, domestic producers will have prompt access to the market created by the program.
- **Targeted:** Waivers that are not limited to particular projects should apply only to the item(s), product(s), or material(s) or category(ies) of item(s), product(s), or material(s) necessary. Waivers that are overly broad will tend to undermine domestic preference policies. Broader waivers will receive greater scrutiny from MIAO.
- **Conditional:** Federal agencies are encouraged to issue waivers with specific conditions that support the policies of the Act and the Executive Order.

These principles and criteria should be viewed as minimum requirements for the use of waivers by Federal agencies.³⁰

Nonavailability Waivers

Before granting a nonavailability waiver, agencies should consider whether the recipient has performed thorough market research, which may be accomplished with assistance from the agency, and adequately considered, where appropriate, qualifying alternate items, products, or

²⁹ IJA § 70933(2).

³⁰ See Section IV. of this guidance for agencies that have existing regulations or guidance.

materials. Waivers should describe the market research activities and methods to identify domestically manufactured items capable of satisfying the requirement, including the timing of the research and conclusions reached on the availability of sources. Agencies are encouraged to engage with the Made in America Council to develop resource lists for common items, goods, or materials.

Unreasonable Cost Waivers

An unreasonable cost waiver is available if the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. Before granting an unreasonable-cost waiver, to the extent permitted by law, agencies should ensure the recipient has provided adequate documentation that no domestic alternatives are available within this cost parameter. Agencies may assist recipients in gathering documentation.

For requests citing unreasonable cost as the statutory basis of the waiver, the waiver justification must include, as applicable, a comparison of the cost of the domestic product to the cost of the foreign product or a comparison of the overall cost of the project with domestic products to the overall cost of the project with foreign-origin products, pursuant to the requirements of the applicable Made in America law.³¹ Publicly available cost comparison data may be provided in lieu of proprietary pricing information.³² Unreasonable-cost waivers should be no broader than necessary.

Public Interest Waivers

A waiver in the public interest may be appropriate where an agency determines that other important policy goals cannot be achieved consistent with the Buy America requirements established by the Act and the proposed waiver would not meet the requirements for a nonavailability or unreasonable cost waiver. Such waivers shall be used judiciously and construed to ensure the maximum utilization of goods, products, and materials produced in the United States.³³ To the extent permitted by law, determination of public interest waivers shall be made by the head of the agency with the authority over the Federal financial assistance award.³⁴

Public interest waivers may have a variety of bases. As with other waivers, they should be project-specific whenever possible, as what is in the public interest may vary depending upon the circumstances of the project, recipient, and specific items, products, or materials in question.

Federal agencies may wish to consider issuing a limited number of general applicability public interest waivers in the interest of efficiency and to ease burdens for recipients. The agency remains responsible for determining whether such a waiver is appropriate to apply to any

³¹ IIJA, § 70937(c)(2)(B).

³² IIJA, § 70937(c)(2)(B).

³³ IIJA, § 70935(a).

³⁴ IIJA, § 70935(b).

given project; the Made in America Office will not review each application of such a waiver. The following are examples of types of public interest waivers an agency may consider issuing.³⁵

- **De Minimis:** Ease of administration is important to reduce burden for recipients and agencies. Federal agencies may consider whether a general applicability public interest waiver should apply to infrastructure project purchases below a de minimis threshold. An agency may consider whether a public interest waiver should apply when necessary to ensure that recipients and Federal agencies make efficient use of limited resources, especially if the cost of processing the individualized waiver(s) would risk exceeding the value of the items waived. Agencies may consider adopting an agency-wide public interest waiver that sets a de minimis threshold, for example, of 5 percent of project costs up to a maximum of \$1,000,000.
- **Small Grants:** Agencies may wish to consider whether it is in the public interest to waive application of a Buy America preference to awards below the Simplified Acquisition Threshold. This type of waiver may be particularly relevant in the initial years after enactment of IIJA, and may be phased out over time as agencies develop efficient waiver review capabilities.
- **Minor Components:** Agencies may wish to consider whether it is in the public interest to allow minor deviations for miscellaneous minor components within iron and steel products. A minor components waiver in the public interest may allow non-domestically produced miscellaneous minor components comprising no more than 5 percent of the total material cost of an otherwise domestically produced iron and steel product to be used. It would not be in the public interest to use a minor components waiver to exempt a whole product from the iron and steel requirements, or to allow the primary iron or steel components of the product to be produced other than domestically.
- **Adjustment Period:** Agencies should consider whether brief, time limited waivers to allow recipients and agencies to transition to new rules and processes may be in the public interest.
- **International Trade Obligations:** If a recipient is a State that has assumed procurement obligations pursuant to the Government Procurement Agreement or any other trade agreement, a waiver of a Made in America condition to ensure compliance with such obligations may be in the public interest.
- **Other Considerations:** A waiver may be in the public interest in one circumstance, but not in another, and considerations will depend upon the nature and amount of resources available to the recipient, the value of the items, goods, or materials in question, the potential domestic job impacts, and other policy considerations, including sustainability, equity, accessibility, performance standards, and the domestic content (if any) of and conditions under which the non-qualifying good was produced.

All proposed waivers citing the public interest as the statutory basis must include a detailed written statement, which shall address all appropriate factors, such as potential

³⁵ The list is not exhaustive and no agency is required to issue the types of waivers noted as examples. As with other general applicability waivers, generally applicable public interest waivers must be reviewed at least every five years and more often as appropriate.

obligations under international agreements, justifying why the requested waiver is in the public interest.³⁶

Before granting a waiver in the public interest, to the extent permitted by law, agencies shall assess whether a significant portion of any cost advantage of a foreign-sourced product is the result of the use of dumped steel, iron, or manufactured products or the use of injuriously subsidized steel, iron, or manufactured products.³⁷ Agencies may consult with the International Trade Administration (ITA) in making this assessment if the granting agency deems such consultation to be helpful. The agency shall integrate any findings from the assessment into its waiver determination as appropriate.³⁸ MIAO will work with ITA and agencies to develop standard processes to expedite this required assessment, such as by ensuring agencies know how to easily access lists of dumped or injuriously subsidized products.

c. General Applicability Waivers

The term “general applicability waiver” refers to a waiver that applies generally across multiple awards. A general applicability waiver can be “product-specific” (e.g., applies only to a product or category of products) or “non-product specific” (e.g., applies to all “manufactured products”).

General applicability waivers should be issued only when necessary to advance an agency’s missions and goals, consistent with IIJA, the Executive Order, and this guidance. For example, an agency might issue a general waiver for a product for which there are well-established domestic sourcing challenges. General applicability waivers will require appropriate justification from the Federal agency.

Federal agencies with one or more existing general applicability waivers, including public interest waivers, must review such waivers within five years of the date on which the waiver was issued. Agencies issuing new general applicability waivers must review such waivers at least every five years from the date of issuance. Agencies are encouraged to review general applicability waivers more frequently, when appropriate. In conducting a review of any general applicability waiver, the head of a Federal agency shall—

- (A) publish in the *Federal Register* a notice that—
 - (i) describes the justification for a general applicability waiver; and
 - (ii) requests public comments for a period of not less than 30 days on the continued need for a general applicability waiver; and
- (B) publish in the *Federal Register* a determination on whether to continue or discontinue the general applicability waiver, considering the comments received in response to the notice published under paragraph (A).³⁹

³⁶ IIJA, § 70937(c)(2)(C).

³⁷ Executive Order, § 5.

³⁸ Executive Order, § 5.

³⁹ IIJA, § 70914(d)(1) & (2).

For a period of five years beginning on the date of enactment of the Act, paragraphs (A) and (B) above shall not apply to any product-specific general applicability waiver that was issued more than 180 days before November 15, 2021.⁴⁰

By no later than November 15, 2022, agencies with existing, non-product specific general applicability waivers that were issued more than five years before November 15, 2021 should promptly commence review of each such waiver by publishing a *Federal Register* notice as required in section 70914(d)(2)(A) of the IIJA. Should the review justify retaining the waiver, agencies should consider narrowing the waiver in a manner that would support supply chain resilience and boost incentives to manufacture key products domestically, as appropriate.

To ensure prompt commencement of projects funded by IIJA, MIAO plans to work with agencies to expedite consideration of general applicability waivers for products or categories of products for which domestic sourcing challenges have been well documented. Agencies should align such waivers with complementary policies, such as work to boost supply chain resiliency and domestic employment. General applicability waivers should include appropriate expiration dates designed to ensure that, once available, Buy America qualifying products receive appropriate consideration.

VIII. Preliminary Guidance for Construction Materials

For construction materials, the Act requires that, not later than 180 days after November 15, 2021, OMB must issue standards that define the term “all manufacturing processes” in the case of construction materials. These standards must require that each manufacturing process required for the manufacture of the construction material and the inputs of the construction material occurs in the United States. They must also reflect efforts to maximize the direct and indirect jobs benefited or created in the production of the construction material.⁴¹

Although the deadline to issue such guidance has not yet passed, OMB is providing preliminary and non-binding guidance to assist agencies in determining which materials are construction materials so that agencies can begin applying Buy America requirements to those materials. This preliminary guidance addresses the requirements as set forth in section 70915(b) of the IIJA while providing sufficient time for OMB to receive additional stakeholder input.

The IIJA finds that “construction materials” includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives⁴²—that is or consists primarily of:

- non-ferrous metals;
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
- glass (including optic glass);

⁴⁰ IIJA, § 70914(d)(3).

⁴¹ IIJA, § 70915(b).

⁴² IIJA, § 70917(c)(1).

- lumber; or
- drywall.⁴³

To provide clarity to item, product, and material manufacturers and processors, we note that items that consist of two or more of the listed materials that have been combined together through a manufacturing process, and items that include at least one of the listed materials combined with a material that is not listed through a manufacturing process, should be treated as manufactured products, rather than as construction materials. For example, a plastic framed sliding window should be treated as a manufactured product while plate glass should be treated as a construction material.

Pending OMB's issuance of final standards on construction materials, and absent any existing applicable standard in law or regulation that meets or exceeds these preliminary standards, agencies should consider "all manufacturing processes" for construction materials to include at least the final manufacturing process and the immediately preceding manufacturing stage for the construction material. OMB is seeking additional stakeholder input before issuing further guidance identifying initial manufacturing processes for construction materials that should be considered as part of "all manufacturing processes."

Agencies should consult with MIAO, as needed, to ensure that any waiver issued for construction materials is explicitly targeted and time-limited, in order to send a clear market signal that additional standards for "all manufacturing processes" in the case of construction materials will be forthcoming.

⁴³ See IIIA, § 70911(5).

Appendix I: Example of Award Term - Required Use of American Iron, Steel, Manufactured Products, and Construction Materials

Where applicable, the Federal agency must include appropriate terms and conditions in all awards, in accordance with applicable legal requirements and its established procedures, in order to effectuate the requirements of the Act and this guidance. The following is sample language.

To achieve the greatest possible consistency across agencies and programs, agencies should send their proposed terms and conditions to MIAO for review prior to incorporating them into applicable awards. Agencies should begin including appropriate language in NOFOs published *before* May 14, 2022 to provide applicants fair notice of the Buy America conditions that will apply to funds obligated on or after that date.

** ** **

Recipients of an award of Federal financial assistance from a program for infrastructure are hereby notified that none of the funds provided under this award may be used for a project for infrastructure unless:

- (1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
- (2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
- (3) all construction materials⁴⁴ are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

⁴⁴ Excludes cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives.

Waivers

When necessary, recipients may apply for, and the agency may grant, a waiver from these requirements. The agency should notify the recipient for information on the process for requesting a waiver from these requirements.

- (a) When the Federal agency has made a determination that one of the following exceptions applies, the awarding official may waive the application of the domestic content procurement preference in any case in which the agency determines that:
- (1) applying the domestic content procurement preference would be inconsistent with the public interest;
 - (2) the types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
 - (3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

A request to waive the application of the domestic content procurement preference must be in writing. The agency will provide instructions on the format, contents, and supporting materials required for any waiver request. Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

There may be instances where an award qualifies, in whole or in part, for an existing waiver described at [\[link to awarding agency web site with information on currently applicable general applicability waivers\]](#).

*Definitions*⁴⁵

“Construction materials” includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives⁴⁶—that is or consists primarily of:

- non-ferrous metals;
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
- glass (including optic glass);
- lumber; or
- drywall.

⁴⁵ Federal agencies may choose to provide definitions on a public-facing website and reference that website in the terms and conditions, rather than including all definitions in the terms and conditions itself. If an agency chooses to do provide definitions on a public-facing website, it is not considered a deviation from the terms and conditions provided and does not need to be reviewed by OMB.

⁴⁶ IIIA, § 70917(c)(1).

“Domestic content procurement preference” means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

“Infrastructure” includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

“Project” means the construction, alteration, maintenance, or repair of infrastructure in the United States.

BID FORMS

The bid forms are not available online. The bid forms are available only by purchasing a set of plans and specifications at the location indicated in the Advertisement for Bids/Public Notice to Bidders.

SECTION 2
CONTRACT FORMS

NOTICE OF AWARD

TO: «ContractName»
«ContractAddr»
«ContractCity», «ContractState» «ContractZip»

DATE: _____

PROJECT: «TitleCaps»

You are notified that your Bid which was opened on «Bidopening» has been accepted for items in the amount of «ContractDollars» at the unit bid prices as reflected in the bid tabulation contained herein for the *(fill in awarded parts, i.e. for Base Bid and Alternate C, ... or delete)*.

You are required by the Instructions to Bidders to execute the Agreement and furnish the required Bonds, Certificates of Insurance, and other documents within 10 calendar days from the date of receipt of this Notice.

Failure to comply with these conditions within the time specified will entitle Owner to consider your Bid in default, to annul this Notice and to declare your Bid Security forfeited.

The Owner will return to you one (1) fully signed set of the contract documents.

«OwnerCaps»

«OwnerCEOFirst» «OwnerCEOLast», «OwnerCEOTitle»

ACKNOWLEDGMENT

«ContractCAPName»

«ContractFirst» «ContractLast», «ContractTitle»

CONTRACT

FOR «TitleCaps»

THIS CONTRACT, made and entered into at «OwnerCity», «OwnerState», this _____ day of _____, 20____, by and between the «OwnerMuni» (“OWNER”), «OwnerState» and «ContractName» (“CONTRACTOR”).

WITNESSETH: That the said CONTRACTOR has agreed and by this presents does agree with the OWNER for the consideration hereinafter mentioned and contained, and under penalty expressed in a bond given with these presents, and herein contained or hereunto annexed, to furnish at its own cost and expense, all the necessary tools, equipment, materials, labor, and tests in an expeditious, substantial and workmanlike manner, the equipment and appurtenances herein contemplated, commencing work within 20 days from the date of the Notice to Proceed and executing the work within the time and in the manner specified and in conformity with the requirements set forth in this Contract.

The following form essential parts of the Contract (may vary with project).

1. Advertisement for Bids/Public Notice to Bidders
2. Instruction to Bidders
3. Bid Forms and Proposal
4. Contract Forms and Exhibits
5. Contract Bond – ORC 153.571 or ORC 153.57
6. Contract Provisions
7. General Conditions
8. Supplementary Conditions
9. Specifications
10. Specific Project Requirements
11. Prevailing Wage Rate Schedule
12. Contract Drawings; if any.
13. Addenda; if any.

The CONTRACTOR agrees and understands that the work on this contract shall be subject to the acceptance of the OWNER based upon and in accordance with the contract specifications and contract plans and drawings on file in the office of the OWNER.

The CONTRACTOR agrees that each individual employed by the CONTRACTOR or any Subcontractor and engaged in work on the project under this contract shall be paid by prevailing wage established by the Department of Industrial Relations of the State of Ohio or the U.S. Department of Labor (Davis-Bacon Act) as detailed in the section titled "Wage Rates." This shall occur regardless of any contractual relationship which may be said to exist between the Contractor or any Subcontractor and such individual. *(if a School District, delete this paragraph)*

The CONTRACTOR shall proceed with the said work in a prompt and diligent manner and shall do the several parts thereof. Further the CONTRACTOR shall complete the whole of said work in accordance with the specifications and contract drawings to the satisfaction of the OWNER on or before the time stated, and in default of completion within the time as fixed, the CONTRACTOR shall pay to the OWNER as liquidated damages, an amount equal to «Liquidated», for each and every day (Sundays and legal holidays excepted) the completion of the work may be delayed beyond the date fixed in the manner and as stipulated.

It is hereby mutually agreed that the OWNER is to pay and the CONTRACTOR is to receive, as full compensation for furnishing all materials and labor in building, constructing and testing and in all respect completing the herein described work and appurtenances in the manner and under the conditions herein specified, the prices stipulated in the proposal herein contained or hereto annexed and the total contract sum is «ContractDollars».

This Contract shall be in full force and effect from the date of execution by the OWNER and CONTRACTOR.

IN WITNESS WHEREOF: The OWNER and CONTRACTOR hereunto affixed their signature the day and year first mentioned above.

«ContractCAPName»

«ContractFirst» «ContractLast», «ContractTitle»

«OwnerCaps»

«OwnerCEOFirst» «OwnerCEOLast», «OwnerCEOTitle»

I hereby certify that funds in the amount of «ContractAmtwords» Dollars («ContractDollars») necessary for the foregoing Contract have been appropriated and are in the Treasury, or are in the process of collection, or are available through grants and/or loans from other funding sources.

«OwnerFiscalFirst» «OwnerFiscalLast», «OwnerFiscalTitle»

APPROVED AS TO FORM:

«OwnerLegalName», «OwnerLegalTitle»

**THE CONTRACTOR SHALL FURNISH THE FOLLOWING ITEMS
WITHIN 10 DAYS OF NOTIFICATION OF AWARD:**

- A) CERTIFICATE OF INSURANCE FOR
CONTRACTOR'S PUBLIC LIABILITY INSURANCE POLICY
AND AUTOMOTIVE INSURANCE POLICY**
*Owner, Verdantas LLC, CT Consultants, Inc., the Ohio EPA Director and the Ohio Water
Development Authority Named as Additional Insured*
- B) CERTIFICATE OF INSURANCE FOR
OWNER'S AND CONTRACTOR'S PROTECTIVE POLICY**
Owner Named as Insured (No Additional Insured)
- C) CERTIFICATE OF WORKER'S COMPENSATION**
- D) CONTRACT BOND THAT COMPLIES WITH ORC 153.54 AND 153.57**

* D above is not required if a bond complying with ORC 153.54 and 153.571 (rollover bond) was submitted at time of bid.

DELINQUENT PERSONAL PROPERTY STATEMENT

STATE OF _____)
) SS
COUNTY OF _____)

«ContractName», having been awarded a contract by the «OwnerMuni», «OwnerState», hereby affirms under oath, pursuant to Ohio Revised Code Section 5719.042, that at the time the bid was submitted, my company **was / was not (CIRCLE ONE)** charged with delinquent personal property taxes on the General Tax List of Personal Property for «OwnerCounty» County, Ohio.

If such charge for delinquent personal property tax exists on the General Tax List of Personal Property for «OwnerCounty» County, Ohio, the amount of such due and unpaid delinquent taxes, including due and unpaid penalties and interest shall be set forth below.

A copy of this statement shall be transmitted by the Taxing District's Fiscal Officer to the County Treasurer within thirty days of the date it is submitted. A copy of this statement shall also be incorporated into the Contract made between «OwnerMuni», «OwnerState», and «ContractName», and no payment shall be made with respect to any Contract unless such statement has been so incorporated as a part thereof.

Delinquent Personal Property Tax	\$ _____
Penalties	\$ _____
Interest	\$ _____

«ContractCAPName»

«ContractFirst» «ContractLast», «ContractTitle»

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

Notary Public

My Commission Expires: _____

AFFIDAVIT
OF COMPLIANCE WITH OHIO REVISED CODE SECTION 3517.13

STATE OF _____)
) SS
COUNTY OF _____)

_____ being duly sworn deposes and states as follows:

1. I am duly authorized to make the statements contained herein on behalf of _____ (“the Contracting Party”).
2. The Contracting Party is a/an (select one):
 - ☐ Individual, partnership, or other unincorporated business association (including without limitation, a professional association organized under Ohio Revised Code Chapter 1787), estate, or trust
 - ☐ Corporation organized and existing under the laws of the State of _____
 - ☐ Labor organization
3. I hereby affirm that the Contracting Party and each of the individuals specified in R.C. 3517.13(I) (with respect to non-corporate entities and labor organizations) or R.C. 3517.13(J) (with respect to corporations) are in full compliance with the political contribution limitations set forth in R.C. 3517.13(I) and (J), as applicable.
4. I understand that a false representation on this certification will incur penalties pursuant to 3517.992(R).

Affiant further sayeth naught.

By: _____

Title: _____

SWORN TO BEFORE ME and subscribed in my presence this _____ day of _____, 20_____.

Notary Public

My commission expires: _____

APPROVED SUBCONTRACTORS

PROJECT: «TitleCaps»

PRIME CONTRACTOR: «ContractCAPName»

To be filled out by Prime Contractor and signed by Owner.

1. Name: _____

Address: _____

City/State/Zip: _____

Description of Work: _____

Phone: () _____ Amount: \$ _____ % of Contract: _____

EIN# _____ Unique Entity ID# _____

2. Name: _____

Address: _____

City/State/Zip: _____

Description of Work: _____

Phone: () _____ Amount: \$ _____ % of Contract: _____

EIN# _____ Unique Entity ID# _____

3. Name: _____

Address: _____

City/State/Zip: _____

Description of Work: _____

Phone: () _____	Amount: \$ _____	% of Contract: _____
EIN# _____	Unique Entity ID# _____	

4. Name: _____

Address: _____

City/State/Zip: _____

Description of Work: _____

Phone: () _____ Amount: \$ _____ % of Contract: _____

EIN# _____ Unique Entity ID# _____

«OwnerCaps»

«OwnerCEOFIRST» «OwnerCEOLAST», «OwnerCEOTITLE»

NOTICE TO PROCEED

Project: «Title»

Owner: «OwnerMuni»
«OwnerAddr»
«OwnerCity», «OwnerState» «OwnerZip»

To: «ContractName»
«ContractAddr»
«ContractCity», «ContractState» «ContractZip»

Date: _____

You are hereby notified to commence work in accordance with the Contract. All work shall be completed by «Completion_Date».

«OwnerCaps»

«OwnerCEOFirst» «OwnerCEOLast», «OwnerCEOTitle»

THE OWNER OR THEIR AUTHORIZED REPRESENTATIVE SHALL INSERT THE FOLLOWING CONTRACT DOCUMENTATION IN THE EXECUTED CONTRACT:

A) FINDINGS FOR RECOVERY – ORC 9.24
(<http://ffr.ohioauditor.gov/>)

B1) CHECK FOR DEBARRED CONTRACTORS IN THE STATE OF OHIO
(<https://www.sos.state.oh.us/records/debarred-contractors/>)

**B2) CHECK FEDERAL SAM (System for Award Management) for
FEDERAL FUNDING (including sub-contractors), (if applicable)**
(<https://www.sam.gov/SAM/>)

**C) NOTIFICATION OF SURETY AND AGENT OF CONSTRUCTION
CONTRACT AWARD – ORC 9.32 (if applicable)**

**D) NOTIFICATION TO UTILITY COMPANIES OF COMMENCEMENT
OF CONTRACT EXECUTION – ORC 153.64 (if applicable)**

SECTION 3
GENERAL CONDITIONS

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by



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NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by



CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 6. *Bidder*—The individual or entity who submits a Bid directly to Owner.
 7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
 9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.
16. *Cost of the Work*—See Paragraph 11.01 for definition.
17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
19. *Engineer*—The individual or entity named as such in the Agreement.
20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
21. *General Requirements*—Sections of Division 1 of the Specifications.
22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
30. *PCBs*—Polychlorinated biphenyls.
31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.
37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.
46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
49. *Unit Price Work*—Work to be paid for on the basis of unit prices.
50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of

the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

- A. Standards, Specifications, Codes, Laws, and Regulations
 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

- A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
 1. A Field Order;
 2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
 2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the

Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

- 1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
- 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

- 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
- 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
- 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

- 1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
- 2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other

professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents;
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price

or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by

Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

- B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
 - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
6. include completed operations coverage:
 - a. Such insurance shall remain in effect for two years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and
 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property

insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

- E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery

against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.
1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
 - 3) it has a proven record of performance and availability of responsive service.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:
 - a) perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
 - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services; and

- 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or

other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all

court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 Taxes

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 Use of Site and Other Areas

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor

shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

- D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
1. all persons on the Site or who may be affected by the Work;
 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*
 - a. Submit number of copies specified in the General Requirements.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.
 2. *Samples:*
 - a. Submit number of Samples specified in the Specifications.
 - b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.
- B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Submittal Procedures:*
1. Before submitting each Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop

Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. Engineer's Review:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. Resubmittal Procedures:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
 6. any inspection, test, or approval by others; or
 7. any correction of defective Work by Owner.

6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor,

Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
1. written notice thereof will be given to Contractor prior to starting any such other work; and
 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits

and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The

opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part;
 2. approve the Claim; or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on

Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

- a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
- b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 2. there is no corresponding adjustment with respect to any other item of Work; and
 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

- c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
- d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the

control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and
 - 3. as otherwise specifically provided in the Contract Documents.

- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. repair such defective land or areas; or
 - 2. correct such defective Work; or
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute

resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and

equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the

Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications:

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or

- b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due:

- 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment:

- 1. Owner may refuse to make payment of the full amount recommended by Engineer because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. there are other items entitling Owner to a set-off against the amount recommended; or

- d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities

pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
 - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's repeated disregard of the authority of Engineer; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
 - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agrees with the other party to submit the Claim to another dispute resolution process; or
 - 3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 4
SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2007 ed.) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented herein or in the Specific Project Requirements remain in full force and effect.

SC-1.01 The terms used in these Supplementary Conditions which are defined in the General Conditions have the meaning assigned to them in the General Conditions.

SC-2.02 Delete paragraph 2.02(A) in its entirety and insert the following in its place:

Owner shall furnish one (1) printed/hard copy of the drawings and Project Manual which shall be an executed contract set and one set in electronic format (.pdf), if requested.

SC-2.03 (A) In the last sentence of 2.03A, change "sixtieth day" to "one hundred fiftieth day."

SC-2.03 (B) By submission of a bid, the bidder hereby grants consent that the award and execution period shall be extended from 60 days to 120 days after the date on which the bids are opened.

SC-4.02(A) Change "Supplementary Conditions" to read "Specific Project Requirements."

SC-4.06(G) Delete paragraph 4.06(G) in its entirety.

SC-5.03(A)(1) The required Certificate of Insurance shall be in a form satisfactory to the Owner (most current version of ACORD 25 or approved equal). If the Contractor fails to procure and maintain any specified and/or required insurance, the Owner shall have the right to procure and maintain the said insurance for and in the name of the Contractor and the Contractor shall pay the cost thereof and shall furnish all necessary information to make effective and maintain such insurance.

SC-5.04(B)(1) Change "Supplementary Conditions" to read "Specific Project Requirements."

SC-5.04(B)(2) The limits of liability for the insurance required by paragraph 5.04(A) of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

All of the limits below may be satisfied with an Umbrella/Excess Liability as needed to increase the Primary Policy to required limits.

5.04(A)(1) and (2) Workers' Compensation, etc., under paragraphs 5.04(A)(1) and 5.04(A)(2) of the General Conditions:

(a) State	Statutory
(b) Applicable Federal (e.g., Longshoreman's):	Statutory
(c) Employer's Liability:	\$1,000,000

5.04(A)(3), (4) and (5). Contractor's Liability Insurance under paragraphs 5.04(A)(3) through 5.04(A)(5) of the General Conditions which shall also include completed operations and product liability coverage.

- (a) Bodily Injury and Property Damage, Combined Single Limit (CSL) (Except Products and Completed Operations) Property Damage liability insurance will provide Explosion, Collapse, and Underground coverage where applicable.

Each Occurrence	\$2,000,000

General Aggregate	\$4,000,000

- (b) Products and Completed Operations Aggregate \$1,000,000

Products and Completed Operations to be maintained for two (2) years after final payment and Contractor shall continue to provide evidence of such coverage to the Owner on an annual basis during the aforementioned period.

- (c) Personal and Advertising Injury (Per Person/Organization and per occurrence). \$1,000,000

- (d) Fire Damage \$100,000

- (e) If the General Liability Policy includes a General Aggregate, such policy shall be endorsed to have the General Aggregate Per Project Aggregate Limit.

5.04(A)(6) Automobile Liability - (Owned, Non-Owned, Hired)
Contractor may provide split limits or combined single limit.

- (a) Split Limits:

Bodily Injury,	Each Person:	\$2,000,000
	Each Occurrence	\$2,000,000

Property Damage,	Each Occurrence	\$1,000,000

or

- (b) Combined Single Limit

Bodily Injury and Property Damage,	
Each Occurrence	\$2,000,000

SC-5.04(B)(3) Add the following to the end of the paragraph: “to the extent available in the insurance industry with industry standard exclusions and as allowed under the laws and regulations in the State of Ohio;”

SC-5.04(B)(4) Add the following:

Written notice of cancellation for non-payment of premium shall be at least 10 days.

Add the following section:

SC-5.04(C) Unless otherwise stated in Specific Project Requirements, the Contractor shall purchase and provide an "Owner's and Contractor's Protective Policy" with an immediate Effective Date and the **Owner listed as the Insured (No additional insureds)** for the following limits:

Each Occurrence	\$1,000,000
General Aggregate	\$2,000,000

Add the following section:

SC-5.04(D) Unless otherwise stated in Specific Project Requirements the Contractor shall purchase and maintain during the Contract Time "All Risk Builders' Risk Insurance," and/or "Installation Floater Insurance," and/or "Boiler and Machinery Insurance," and any and all insurance requirements of section GC-5.06 of the General Conditions as applicable for the type of work to be performed upon the Project to the full insurable value thereof for the benefit of the Owner, the Contractor, Subcontractors and Suppliers as their interest may appear. This insurance shall cover the work until final acceptance and final payment by the Owner. This provision shall in no way release the Contractor or Contractor's Surety from obligations under the Contract Documents to fully complete the Project. The original policy(s) shall be filed with the Owner or his designated representative.

SC-5.05 *Owner's Liability Insurance*

See SC-5.04(C) above.

SC-5.06 *Property Insurance*

Unless otherwise stated in Specific Project Requirements, the Contractor, not the Owner, shall purchase and maintain during the Contract Time all property insurance required in section GC-5.06 of the General Conditions and as outlined in SC-5.04(D) above.

Add the following section:

SC-6.02(C) The Contractor shall be responsible for the Owner and/or Engineer's additional inspection and administrative costs for work performed beyond regular working hours as defined in this Section.

SC-6.07(B) Delete paragraph 6.07(B) in its entirety.

SC-6.09 (D) Add the following:

D. The contractor agrees to the requirements of RC 153.59, RC 153.591, and RC 153.60.

Add the following section:

SC-6.10(B) Add the following:

Should the Owner be exempt from Ohio State Sales and Use Taxes on materials and equipment to be incorporated in the Project, the Contractor may obtain a waiver and said taxes shall not be included in the Contract Price.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the work
2. Owner's exemption to Contractor does not apply to construction tools, machinery, equipment, or other property by or leased by Contractor, or to supplies or materials not incorporated into the work.

The Contractor shall withhold and/or pay all consumer, use, property, employment, income and other taxes in accordance with the laws and regulations of the United States, State of Ohio, Owner and other applicable agencies which are applicable during the performance of the work.

SC-6.17 *Shop Drawings and Samples*

Add the following new paragraphs immediately after paragraph 6.17(E):

- F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than three (3) submittals. Engineer will record Engineer's time for reviewing subsequent materials of shop drawings, samples, or other items requiring approval and Contractor shall reimburse Owner for Engineer's charges for such time.
- G. In the event that Contractor requests a substitution for a previously approved item, Contractor shall reimburse Owner for Engineer's charges for such time unless the need for such substitution is beyond the control of the Contractor.

SC-7.02 Delete Section 7.02 of the General Conditions in its entirety and insert the following:

SC-7.02(A) The General Construction Contractor shall be referred to and defined as the Construction Coordinator.

SC-7.02(B) Duties of the Construction Coordinator include the following:

1. Scheduling and coordinating the work of the Prime Contractors including submission and periodic updating of project schedule.
2. Establishing and administrating the site safety program and procedures for the project.
3. See that permits are applied for and obtained on a timely basis. Advise the Engineer of any problems related to permit approval.
4. Monitoring compliance with Laws and Regulations.
5. Maintain project site for dust, sedimentation, debris, waste, and general site cleanliness.
6. Coordinate location and use of temporary construction facilities including but not limited to sanitary, water, power, telephone, and parking.
7. Coordinate Owner interface for utility tie-ins/shut downs.
8. Monitor shop drawing submittal and coordination of submittal information between Prime Contractors.

SC-10.01 (A) Add the following:

The Owner may request from the Contractor and the Contractor shall provide within ten days of the request, a quote for all ordered changes in the work or work the Owner may be considering to be ordered. The quote shall be a line item, detailed, itemized breakdown of the work.

SC-11.01(A) For purposes of "Cost of the Work" delete Section 11.01(A), (B), and (C) of the General Conditions in their entirety and insert ODOT 109.05, in its place.

SC-13.07(A) In the First sentence of Section 13.07(A) remove "Substantial Completion" and insert "Final Acceptance of the entire project and final payment by the Owner."

SC-13.07(C) Remove 13.07(C) and replace with the following:

All materials and equipment shall be warranted by the respective material supplier or equipment manufacturer until the end of the Contractor's "correction period" (or longer if specified elsewhere in the contract) regardless of date of initial installation or operation of the material or equipment. The cost of such extended warranties as needed from material suppliers or equipment manufacturers to provide warranty coverage until the end of the "correction period" or other period as specified in the contract shall be the responsibility of the prime contractor and shall be assumed to have been included in his bid.

SC-14.02(A) (3) Delete Section 14.02(A) (3) of the General Conditions in its entirety and insert the following:

Until the job is Substantially Complete, the Contractor will be paid 96% of the estimated value of labor and 100% of the estimated value of material installed and completed in acceptable form. Upon the Owner's agreement that the project is Substantially Complete, the 4% Retainage on labor may be reduced to the value needed to assure completion of the remaining punch list work subject to the recommendation of the Engineer and the approval by the Owner.

Add the following section:

SC-14.02(A) (4)

Payment for stored materials at invoice prices or at the unit price bid for materials, or the lesser value of the two, will be made for accepted nonperishable equipment and materials which are to be incorporated into the work, when accepted, delivered, properly stored, and protected upon the site and verified to the Engineer by a copy of the invoice. For materials and equipment meeting the foregoing conditions, the Owner will pay, when properly included in an approved estimate, 92% of the invoice value of the same. Subsequent to the inclusion of a payment for delivered materials in a progress payment, Contractor shall submit no later than the next payment submission, a partial waiver of lien from each and every supplier for whom delivered materials were paid. If no such waiver is submitted prior to or along with the next payment, the amount of delivered materials paid commensurate with that particular item will be deducted from future payments. No payment for delivered materials shall be made for any items that are scheduled to be incorporated in the work within 30 days of submission of the pay estimate. Delivered materials will not be paid in any given month for a total amount less than \$5,000.00. Payment for delivered materials for such items as pipe backfill and roadway subbase will not be routinely considered.

SC-16.01 Delete Article 16 in its entirety and replace with the following:

10/17

ARTICLE 16 - DISPUTE RESOLUTION AGREEMENT - JUDICIAL SYSTEM

OWNER and CONTRACTOR hereby agree that Article 16 of the General Conditions to the Agreement between OWNER and CONTRACTOR is amended to include the following agreement of the parties:

- 16.01 All claims, disputes and other matters in question between Owner and Contractor arising out of or relating to the Contract Documents or the breach thereof (except for claims which have been waived by the making or acceptance of final payment as provided by Paragraph 14.09) will be decided through the Adams County Court of Common Pleas. Arbitration will be entered into only if agreed upon in writing by both parties.

END OF SECTION

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SECTION 5
SPECIFICATIONS

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 LOCATION OF THE PROJECT

- A. The project is located in the Village of Winchester, Adams County, Ohio. The project site is at 480 Graces Run Road, Winchester, Ohio. The proposed wastewater treatment plant property is owned by the Village of Winchester and located east of the existing wastewater treatment plant.

1.3 PROJECT DESCRIPTION

- A. The existing Village of Winchester WWTP is permitted for 0.14 MGD. This project will replace the existing WWTP and the new WWTP will be constructed at the same site. The new WWTP will have an average daily design flow (ADDF) of 0.25 MGD, maximum daily flow (MDF) of 0.75 MGD and peak hourly flow (PHF) of 1.0 MGD. The increase in design flow will not increase discharge loadings. The New WWTP project includes the construction of the site for the new plant, construction of a new screen building, process tanks and digester tanks for the activated sludge process and digestion equipment, and an ultra-violet (UV) disinfection system. The project also includes a new Service Building, which will house sludge dewatering equipment, chemical feed equipment, a blower room, a sludge storage room, a workshop and an electrical room.
- B. Bid Proposal Form Item No. 1 shall include all labor, materials, and equipment including demolition, excavation, construction of all foundations, structural elements, installation of all equipment, valves and piping, all other work indicated on the Drawings and specified herein, and assumption of the Xylem Water Solutions USA Inc. - Sanitaire Agreement. Contractor shall furnish and install all miscellaneous fittings, penetrations and all connections to provide a complete operating facility. The project includes, but is not limited to, the following improvements:
 - 1. Site Work includes but is not limited to clearing, grading, installation of all piping, yard valves, manholes, valve boxes, waterlines, yard hydrants, access roads, parking, culvert, etc. as shown on the Contract Drawings.
 - 2. Influent Pump Station and Screen Building: install new pumps and screens in a new building.

3. Xylem - Sanitaire Process Tanks: install concrete tanks and Sanitaire ICEAS aeration, clarification and miscellaneous equipment.
 - a. Aeration equipment includes (but is not limited to): air piping, diffusers, guide rails, etc.
 - b. Clarification equipment includes (but is not limited to): Inlet screen, suction hoods, distributor pipes, RAS Air Lift assemblies, skimmer assemblies, etc.
 - c. Miscellaneous equipment includes (but is not limited to): aluminum walkways, railing, slide gates, bolts, link-seals, etc.
4. Sanitaire Digester Tanks: install concrete tanks and Sanitaire digestion equipment.
5. Ultra-Violet (UV) Disinfection Channel: install concrete channel, electrical, and UV light system to disinfect treated wastewater.
6. Service Building: install new service building and designated rooms/bays. Rooms/bays include:
 - a. Sludge Dewatering Bay: install sludge dewatering and polymer feed equipment.
 - b. Blower Bay: install blowers, air delivery piping and central control panel.
 - c. Electrical Room: install motor control centers.
 - d. Office
 - e. Mechanical Room
 - f. Shower Room
 - g. Toilet Room
 - h. Workshop Bay
 - i. Sludge Storage Bay
7. Plant-wide electronic monitoring system.
8. All electrical work as shown on the Contract Drawings and Specifications.

C. Prevailing wage schedules shall be selected in accordance with the following:

1. Building Construction includes the construction, alteration, or repair of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies and the associated installation of utilities and equipment, as well as incidental grading and paving.

2. Highway Construction includes the construction, alteration, or repair of roads, streets, highways, runways, parking areas and most other paving work not incidental to building, residential, or heavy construction.
3. Heavy Construction includes projects that cannot be classified as Building or Highway. Heavy construction is often further distinguished on the basis of the characteristic of particular projects, such as dredging, water and sewer lines, process piping, installation of process equipment, dams, major bridges, and flood control projects.

1.4 SEQUENCE OF CONSTRUCTION

- A. The Contractor will be required to provide his own detailed sequence of construction in writing prior to commencing any work. The Contractor is responsible to maintain the proper operation of the existing WWTP during construction. Below is a probable generalized sequence of construction.
 1. New sanitary sewer manhole and sewers shall be installed first.
 2. Sewer shall be sent to existing sanitary lagoon during construction.
 3. When new site is developed, contractor shall determine and proceed with the most advantageous sequence of construction of the tanks, buildings, piping, etc. on the new site.
 4. Construction shall begin on the influent piping in such a manner that the completion of this construction can be synchronized with the new plant going online.
 5. Demolition of existing wastewater treatment plant to occur last.

1.5 SPECIFICATIONS

- A. In general, these Specifications describe the work to be performed by the various trades, other than work specifically excluded. It shall be the responsibility of the Contractor and Subcontractors to perform all work incidental to their trade, whether or not specific mention is made of each item, unless such incidentals are included under another Item.
- B. It is advised that the Contractor and all Subcontractors familiarize themselves with the contents of the complete Specifications, particularly for the trades preceding, following, related or adjacent to their work.

1.6 CONTRACTOR USE OF SITE

- A. Access to Site: Limited to areas noted on Drawings.
- B. Construction Operations: Limited to areas noted on Drawings.

- C. Time Restrictions for Performing Work, Monday through Friday, 7:00 A.M. to 7:00 P.M. The WWTP operations staff normally works until 3:00 P.M. Monday through Friday and then locks the main entrance gate. The Contractor will need to coordinate ahead of time for work at existing WWTP, for all periods of work beyond staff's normal work hours.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All new manufactured materials shall be used.
- B. All equipment shall be purchased, furnished, installed, started and commissioned by the Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Execute requirements according to contract documents.

END OF SECTION 011100

SECTION 011419 – USE OF SITE

PART 1 - GENERAL

1.1 GENERAL

- A. The Contractor will be allowed the use of as much of the site designated for the improvements as is necessary for his operation.

1.2 USE OF STREETS

- A. During the progress of the work, the Contractor shall make ample provisions for both vehicle and pedestrian traffic on any public street and shall indemnify and save harmless the Owner from any expense whatsoever due to their operations over said streets. The Contractor shall also provide free access to all the fire hydrants, water, and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked only one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public.
- B. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and may deduct the cost of such work from any monies due the Contractor under this Agreement, but the performance of such work by the Owner at its instance shall serve in no way to release the Contractor from his general or particular liability for the safety of the public or the work.
- C. The Contractor shall repair at no cost to the Owner, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Contractor shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or walks by his equipment or that of subcontractors or suppliers.

1.3 CLOSING STREETS TO TRAFFIC

- A. The Contractor may with the approval of the Engineer, close streets, or parts of streets, to vehicular traffic. The streets are to remain closed as long as the construction work or the condition of the finished work requires or as determined by the Engineer. The Engineer shall be the judge of how many streets or parts of streets it is necessary for the Contractor to close at any time, and may refuse to permit the closing of additional streets to traffic until the majority of the work on the closed streets is completed and they are opened to traffic.

1.4 RIGHTS-OF-WAY

- A. Whenever it is required to perform work within the limits of public or private property or in rights-of-way, such work shall be done in conformity with all agreements between the Owner and the owners of such. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.
- B. The Contractor shall not (except after consent from the proper parties) enter or occupy with men, tools or equipment, any land outside the rights-of-way or property of the Owner.
- C. When the Contractor performs construction within 10 ft. of a right-of-way or easement line, he shall place tall stakes properly identified at points of change in width or direction of the right-of-way or easement line and at points along the line so that at least two stakes can be seen distinctly from any point on the line.

1.5 EASEMENTS

- A. Where the work is to be constructed upon easements, such easements will be secured by the Owner without cost to the Contractor. The Contractor shall not enter upon or occupy any private property outside of the limits of the easements furnished.
- B. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

1.6 PROTECTING EXISTING BUILDINGS, STRUCTURES AND ROADWAYS

- A. The Contractor shall, at his own expense, shore up and protect any buildings, roadways, utilities or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or material, but the cost of this work must be included in the price stipulated for the work to be done under this contract.

1.7 SITE FACILITIES

- A. The Contractor shall furnish and place sufficient quantities of portable toilet facilities at locations convenient for use by the Contractor's personnel, Subcontractors, the Engineer, and the Owner.

1.8 RESTORATION

- A. The Contractor shall restore all areas per the plans and specifications and if not specified, at least to the condition existing prior to the start of work.

END OF SECTION 011419

SECTION 011423 - ADDITIONAL WORK, OVERTIME

PART 1 - GENERAL

1.1 NIGHT, SUNDAY AND HOLIDAY WORK

- A. No work will be permitted at night, Sunday or legal holidays except as noted on the plans or in the case of emergency and then only upon written authorization of the Engineer. Where no emergency exists, but the Contractor feels it advantageous to work at night, Sunday or legal holidays, the Contractor shall notify the Engineer at least two (2) days in advance, requesting written permission. Any work performed during the absence of the Engineer will be done at the Contractor's risk and responsibility and may be subject to rejection upon later inspection.

END OF SECTION 011423

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation or for charges by utilities companies. If necessary, additional requirements will be issued by Change Order.

- B. Types of allowances include the following:

- 1. Lump-sum allowances.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise the Engineer of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At the Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by the Engineer from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances.
- B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.5 LUMP SUM ALLOWANCES

- A. Use the allowances only as directed for the Owner's purposes and only by Work Change Directives that indicate amounts to be charged to the allowance.

- B. The Contractor may be required to solicit quotes from at least 3 subcontractors for Allowance Work.
- C. The Contractor will be allowed a 5% mark-up on all subcontractor or utility company invoices.
- D. At Project closeout, credit unused amounts remaining in the allowances to the Owner.

1.6 UNUSED MATERIALS

- A. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.
 - 1. When requested by the Engineer/Architect, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed by the Architect, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Payment to AEP for Incoming Power Service

Include the sum of \$50,000 for payment to provide the incoming service as shown on the drawings.

- B. Allowance No. 2: System Integration

Include the sum of \$125,000 for the work of the System Integrator, tasked with development and installation of the WWTP SCADA system. Work under this allowance is described in Specification Section 406113 and on the Y series drawings. Contractor shall work with the Owner to obtain proposal(s) and select a System Integrator, after execution of contract.

C. Allowance No. 3: HVAC Heating System & Associated Electrical Work in the Service Building and Screen Building:

Include the sum of \$100,000 for the HVAC heating system and associated electrical work in the Service Building. Contractor shall work with the Owner to obtain proposal(s) for an PTAC units in the service building.

Exhaust fans and louvers as shown on the plans shall be included in the bid price and are not included in this Allowance.

D. Allowance No. 4: Gantry Crane:

Include the sum of \$25,000 for screen gantry crane.

E. Allowance No. 5: Screen Weather Protection Shelter:

Include the sum of \$75,000 for the furnishing and installation of a weather protection shelter for the mechanical screen. The shelter shall provide weather protection for the screen and operator during operation and maintenance activities. The Contractor shall work with the Owner to obtain proposal(s) for the screen shelter.

END OF SECTION 012100

SECTION 012513 – PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 MATERIALS AND EQUIPMENT

- A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified. Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.
- B. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 012513

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION MEETING

- A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.
- B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.
- C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.
- D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

1.2 PROGRESS MEETINGS

- A. Monthly progress meetings will be held at a location to be determined by the Owner on a regularly scheduled day mutually convenient to the Owner, Contractor, and Engineer.
- B. The Contractor shall provide an updated construction progress schedule and be prepared to comment in detail on all aspects of his work.

END OF SECTION 013119

SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 PROGRESS SCHEDULE

- A. Immediately after signing the Contract, the General Construction Contractor shall prepare a graphic progress schedule, indicating the work to be executed during each month and the rate of expected progress to secure completion on the agreed-upon completion date. The progress schedule shall be approved by the Engineer and Owner prior to starting work on the site. Copies of such graphic progress charts, upon which has been indicated the actual progress, shall be furnished to the Engineer with each requisition for payment.
- B. Should the rate of progress fall materially behind the scheduled rate of progress, and unless the delay is authorized by the Engineer, each offending Contractor shall furnish additional labor, work overtime, or take other necessary means required for completion of the work on the scheduled date. No additional compensation beyond the set Contract price shall be paid for action taken or overtime expense incurred in maintaining scheduled progress.

END OF SECTION 013216

SECTION 013223 – SURVEY AND LAYOUT DATA

PART 1 - GENERAL

1.1 STAKING

- A. The Contractor shall hire a surveyor licensed in the state the work is to be installed to provide all reference points not already established and staking. The Contractor shall protect and preserve the established staking and reference points as long as required for installation of the work and field verifications by any party. The Contractor's surveyor shall replace and accurately relocate all staking and reference points so lost, destroyed or moved.

1.2 LAYOUT OF WORK

- A. The Contractor shall lay out his work and be responsible for correct locations, elevations and dimensions of all work executed by him under this Contract. The Contractor must exercise proper precautions to verify the figures shown on the Drawings before laying out the work and will be held responsible for any error resulting from his failure to exercise such precaution. The Contractor shall insure the new construction aligns with any existing work.

END OF SECTION 013223

SECTION 013233 - CONSTRUCTION PHOTOGRAPHS

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 SUMMARY

- A. This Section includes administrative and procedural requirements for the following
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final Completion construction photographs.

1.3 SUBMITTALS FOR REVIEW

- A. Construction Photographs: Contractor shall submit electronic photographic image files within seven (7) days of taking photographs /weekly to the Engineer.
 - 1. Format: Provide photographs as cut and paste files onto Word document (maximum 4 images to a page). Save digital page files in PDF format.
 - 2. Identification: On each page of photos provide the following information:
 - a. Owner's Name
 - b. Contract Description
 - c. Contractor's Name
 - d. Description of view, indicating location, direction (by compass point) and elevation or story of construction
 - e. Date photograph was taken

1.4 COORDINATION

- A. Temporary Serviced: Contractor to cooperate with photographer and provide temporary services request, including access to Project site and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in PDF format as noted above or as otherwise posted to the website as individual photographs, with minimum sensor size of 4 megapixels.

PART 3 - EXECUTION

3.1 GENERAL

- A. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- B. Field Office Prints: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs the same as for those posted on the project's website.

END OF SECTION 013223

SECTION 013319 – FIELD TEST REPORTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes, but is not limited to, services performed by an independent testing laboratory. Laboratory services covered under this section are for testing materials used for field constructed elements of the work. Performance testing of manufactured items and shop fabricated materials shall be covered under their respective specification section.
- B. All testing performed under this item shall be for the protection and benefit of the Owner and shall not be construed by the Contractor as a comprehensive quality control program intended to protect the Contractor, his subcontractors, or his suppliers. The testing frequency and types of testing shall be as scheduled herein.
- C. Inspections, tests, and related actions specified in this section and elsewhere in the contract documents are not intended to limit the Contractor's own quality control procedures and testing, which facilitate overall compliance with requirements of the contract documents. Requirements for the Contractor to provide quality control services as required by the Engineer, the Owner, governing authorities, or other authorized entities are not limited by the provisions of this Section.
- D. The Contractor is required to cooperate with the testing laboratories performing required inspections, test, and similar services and the Engineer or his representative.
- E. Materials and installed work may require testing or retesting at anytime during progress of work. Retesting of rejected materials or installed work shall be done at Contractor's expense.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. The Contract Documents may include testing requirements furnished under other Sections. Work elements which may include other testing requirements are:
 - 1. Water distribution systems.
 - 2. Storm sewer systems.
 - 3. Sanitary sewer systems.
 - 4. Pile foundations
 - 5. Electrical systems tested and certified by the Electrical Contractor
 - 6. Concrete
 - 7. Soil Compaction
 - 8. Asphalt Mix

1.3 SELECTION AND PAYMENT

- A. The Contractor will employ an independent testing laboratory to perform specified testing. Payment shall be incidental to the related work bid item. The laboratory shall be mutually agreed upon by the Owner, Engineer, and Contractor.
- B. Employment of testing laboratory in no way relieves the Contractor of the obligation to perform work in accordance with requirements of the contract documents.
- C. The testing laboratory and their personnel shall be under the direction of the Engineer's on-site representative, regardless of who employs their services.

1.4 REFERENCES

- A. AASHTO T-19, Standard Method of Test for Unit Weight and Voids in Aggregate.
- B. AASHTO T-37, Standard Method of Test for Sieve Analysis of mineral Filler for Road and Paving Materials.
- C. AASHTO T-230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
- D. ASTM C-29, Standard Method of Test for Unit Weight and Voids in Aggregate.
- E. ASTM C-31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- F. ASTM C-33, Standard Specification for Concrete Aggregates.
- G. ASTM C-39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- H. ASTM C-40, Test Method for Organic Impurities in Fine Aggregates for Concrete.
- I. ASTM C-42, Standard Test Methods for Obtaining and Testing Drilled Cored and Sawed Beams of Concrete.
- J. ASTM C-88, Standard Test Method for Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.
- K. ASTM C-94, Standard Specification for Ready-Mixed Concrete.
- L. ASTM C-117, Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
- M. ASTM C-136, Standard Method for Sieve Analysis of Fine and Course Aggregate.
- N. ASTM C-142, Test Method for Clay Lumps and Friable Particles in Aggregate.
- O. ASTM C-143, Standard Test Method for Slump of Hydraulic Cement Concrete.

- P. ASTM C-172, Standard Practice for Sampling Freshly Mixed Concrete.
- Q. ASTM C-173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- R. ASTM C-231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- S. ASTM C-535, Standard Test Method for Resistance to Degradation of Large-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
- T. ASTM C-1064, Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- U. ASTM D-698, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49-kg) Rammer and 12-inc. (305-mm) Drop.
- V. ASTM D-2487, Standard Test Method for Classification of Soils for engineer purposes.
- W. ASTM D-4253, Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- X. ASTM D-4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- Y. ASTM D-4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
- Z. ODOT Supplement 1021, Method of Test for Determination of the Percent of Fractured Pieces in Gravel.
- AA. ODOT Supplement 1029, Method of Test for Determining the Percentage of Deleterious Materials in Course Aggregate.
- BB. ODOT Supplement 1036, Method of Test for Determination of Percent Air Voids in Compacted Dense Bituminous Paving Mixtures.
- CC. ODOT Supplement 1044, Mix Design Method for Bituminous Aggregate Base.
- DD. Uni-Bell PVC Pipe Association UNI-B-6-98 for Low Pressure Air Testing of Installed Sewer Pipe.
- EE. ASTM – C924-02
- FF. ASTM – C969 – Standard practice for infiltration and exfiltration acceptance of installed concrete sewer pipe.

1.5 SUBMITTALS

- A. Prior to the start of work, submit testing laboratory name, address, telephone number, and name of full-time responsible officer.

- B. Submit copy of the testing laboratory's evaluation report issued by one of the evaluation authorities identified in Article 1.6 of this Section with memorandum of remedies of any deficiencies reported by the inspection.
- C. Submit the chain of custody and other QA/QC procedures for each test to be utilized by the laboratory.
- D. Submit a sample test report for review by the Engineer to demonstrate conformance with Article 3.2 herein.

1.6 QUALITY ASSURANCE

- A. Except as otherwise indicated, the testing laboratory engaged shall be prequalified by the Ohio Department of Transportation for the types of services specified herein.
- B. The field personnel utilized to perform all field-testing and preparation shall be certified for those tests being performed.

1.7 RESPONSIBILITIES

A. Testing Laboratory Responsibilities:

- 1. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performance of services.
- 2. Perform specified sampling and testing of products in accordance with the specified standards.
- 3. Ascertain compliance of materials and mixes with requirements of the contract documents.
- 4. Immediately notify the Engineer and Contractor of observed irregularities or nonconformance of work or products.
- 5. Perform additional tests required by the Engineer.
- 6. Testing personnel are to report to the Engineer or his representative upon arrival on site for instructions and requirements. Prior to leaving the site, furnish the Engineer or his representative all test results whether in a formal or informal format.
- 7. Attend preconstruction meetings and progress meetings.

B. Contractor Responsibilities:

- 1. Provide access to materials proposed to be used which require testing.
- 2. Cooperate with laboratory personnel and provide access to the work.
- 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested.
 - b. To obtain and handle samples at the site or at the source of products to be tested.
 - c. To facilitate tests.
 - d. To provide storage and curing of test samples as required by the testing laboratory.

4. Notify the Engineer and laboratory 24 hours prior to expected time for operations requiring testing services for scheduling purposes. Materials will not be permitted to be placed without the proper testing being performed in conformance with this Section.

1.8 LIMITS OF LABORATORY AUTHORITY

- A. The laboratory may not release, revoke, alter, or enlarge the requirements of the contract documents.
- B. The laboratory may not approve or accept any portion of the work.
- C. The laboratory may not assume any duties of the Contractor.
- D. The laboratory has no authority to stop the work.

1.9 SCHEDULE OF TESTS

A. Earthwork

1. Special backfill material sieve analysis per ASTM C-136, one test per source.
2. On-site trench backfill analysis per ASTM D-2487, as directed by Engineer.
3. Pipe bedding and cover sieve analysis per ASTM C-136, one test per source.
4. Drainage fill sieve analysis per ASTM C-136, one test per source.
5. Soil compaction per ASTM D-698.
 - a. Embankment testing shall be at least one (1) test/5,000 S.F. of each lift;
 - b. Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;
 - c. Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or 5,000 S.F. of slabs subject to greater frequency due to soil conditions or Engineer's direction.
6. Backfill compaction per ASTM D-4253 and D-4254, one test per 50 L.F. of each lift.
7. Low Strength Mortar testing per ASTM D-4832.

B. Concrete

1. Concrete aggregate deleterious substances per ASTM C-40, ASTM C-117, and ASTM C-142, one test per source.
2. Concrete aggregate abrasion per ASTM C-535, one test per source.
3. Sodium sulfate soundness of coarse aggregate per ASTM C-88, one test per source.
4. Sampling Fresh Concrete: ASTM C-172, except modified for slump to comply with ASTM C 94.
 - a. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.

- b. Slump: ASTM C-143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - c. Air Content: ASTM C-173, volumetric method of lightweight concrete; ASTM C-231 pressure method for normal weight concrete; at least one for each pour of each type of air-entrained concrete, and each time a set of compression test specimens is made.
 - d. Concrete Temperature: ASTM C-1064, test hourly when air temperature is 40° F. (4° C.) and below, and when 80° F. (27° C.) and above; and each time a set of compression test specimens is made.
 - e. Compression Test Specimen: ASTM C-31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
 - f. Compressive Strength Tests: ASTM C-39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.
 - 1) When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - 2) Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
 - g. Two (2) tests beams shall be made for each 250 square yards of concrete pavement and/or slabs on grade placed.
 - 1) For traffic to be allowed on pavement or slab, the modulus of rupture shall be a minimum of 600 psi for Class C concrete or 400 psi for ODOT Class MS or FS.
 - h. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.
- 5. Nondestructive Testing: Penetration resistance, sonoscope, or other nondestructive devices may be permitted but shall not be used as the sole basis for acceptance or rejection.
 - 6. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

- a. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

C. Pavement

1. Aggregate base sieve analysis per ASTM D-2940, one test per source.
2. Sodium sulfate soundness of aggregate base per ASTM C-88, one test per source.
3. Percent of fractured pieces for aggregate base per ODOT Supplement 1021, one test per source.

D. Asphalt

1. Provide testing for mixture acceptance in accordance with Ohio Department of Transportation Procedures. The person performing the testing must have a current Level 1 Bituminous Concrete approval from ODOT.

E. Sewers

1. Deflection Testing

- a. All thermoplastic gravity sanitary sewer pipe shall be tested for allowable deflection.
- b. Deflection tests shall be performed before final acceptance and no sooner than thirty (30) days after installation of final backfill
- c. Maximum allowable pipe deflection shall be five (5) percent of the average inside diameter for the size and class of pipe specified.
- d. Acceptance testing shall be performed with a non-adjustable "go, no-go" mandrel with a minimum of eight (8) contact points. Adjustable mandrels for acceptance testing shall be used only with permission of the Engineer.
- e. The mandrel size shall be ninety-five (95) percent of the average inside diameter for the size and class of pipe specified.
- f. If the "go, no-go" mandrel will not pass through a section of pipe a deflectometer or adjustable mandrel may be used to determine the extent and/or severity of the non-acceptable area. A "go, no-go" mandrel shall be re-run through the pipe section for final acceptance testing at no additional cost to the Owner.
- g. The Contractor or subcontractor performing the test shall be experienced and qualified to perform deflection testing with the equipment and procedures utilized. The contractor shall provide all labor, materials, tools and equipment necessary to clean and test all sections of sewer pipe, locate deficient areas, repair, deficient areas, and retest all repaired areas.
- h. All sewer runs shall be cleaned prior to testing.
- i. The acceptance test shall be performed without mechanical pulling devices.
- j. All pipe failing the deflection test shall be exposed, repaired or replaced and retested at no additional cost to the Owner.

2. Leakage Testing

- a. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- b. The Contractor shall perform sufficient tests to determine that the installation of all pipe materials have been as specified and that test results are in accordance with those required for approval of the installation.
- c. The Contractor shall furnish all pressure gauges, suitable pump or pumps, pipes, test heads, and any other apparatus and materials used for these tests. These tests are to be considered as part of the work, and no additional compensation shall be made.
- d. The tests shall be conducted under the direction of the Engineer or an appointed agent. Any testing done without direction and supervision as specified shall not be considered as a proper means of approval.
- e. The Contractor may obtain water for testing as may be required by observing the rules and regulations enforced in the municipality in which the work is being done.
- f. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

3. Infiltration and Exfiltration Testing

- a. All sewers shall be tested using an exfiltration test or, where specifically allowed in writing by the Engineer, an infiltration test.
- b. All sewers shall be tested. No visible leakage in the sewers or manholes shall be permitted.
- c. Bulkheads shall be used to isolate the test sections as required to perform the work. All service laterals, stubs and fittings shall be plugged or capped at the connection to the test section.
- d. Each manhole run shall be tested separately.

4. Exfiltration Testing

- a. The test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the sewer or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.
- b. The exfiltration test shall be conducted between two manholes by sealing the downstream end of the test section and all inlet sewers at the upstream manhole with pipe stoppers.
- c. The average internal pressure in the system shall not exceed 11.6 feet of water or 5 psi and the maximum internal pipe pressure at the lowest end shall not exceed 23 feet of water or 10 psi.
- d. Water shall be added to the pipe section at a steady rate from the upstream manhole to allow air to escape from the sewer until the water is at the specified level above the crown of the pipe. The water may stand in the pipe and manhole up to seventy-two (72) hours prior to measurement of leakage to allow for absorption by the pipe and bleeding of air. After absorption into

the pipe and manhole has stabilized, the water in the upstream manhole shall be brought to test level.

- e. The leakage rate shall be determined by measurement of the drop in water elevation measured in the upstream manhole and the loss of water calculated. The test period shall be a minimum of sixty (60) minutes duration. Use the following table to determine loss of water as measured in the manhole:

		Volume of Leakage	
Water Level Change		4 Ft. Dia.	5 Ft. Dia.
in Test Manhole		MH	MH
(Inches)	(Feet)	(Gals.)	(Gals.)
1/8	0.01	0.98	1.53
1/4	0.02	1.96	3.06
3/8	0.03	2.94	4.59
1/2	0.04	3.92	6.12
5/8	0.05	4.90	7.65
3/4	0.06	5.87	9.18
7/8	0.07	6.85	10.71
1	0.08	7.83	12.24
1-1/8	0.09	8.81	13.77
1-1/4	0.10	9.79	15.30
1-3/8	0.11	10.77	16.83
1-1/2	0.12	11.75	18.36
1-5/8	0.13	12.72	19.89
1-3/4	0.14	13.71	21.42
1-7/8	0.16	14.69	22.90
2	0.17	15.67	24.48

5. Infiltration Testing

- a. An infiltration test shall be conducted for all sections of sewer, only when the ground water level is two (2) feet or more above the elevation of the inside crown of pipe at the upstream limit of the section being tested.
- b. The use of well point pumps or other dewatering devices shall have been discontinued for 24 hours prior to testing to permit the groundwater table to return to a static condition.
- c. The leakage rate shall be measured by a weir, by determination of the time required to fill a container of known volume, or other measuring device approved by the Engineer in the lower end of the sewer section to be tested.
- d. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.

6. Allowable Leakage

- a. The maximum allowable leakage for either infiltration or exfiltration shall be (50) gallons per inch of internal pipe diameter per mile per day.
- b. If actual leakage measured exceeds the limits specified, the Contractor must locate and repair or remove and replace the defective pipe sections to the

satisfaction of the Engineer and retest the section accordingly at no additional cost to the Owner.

- c. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one-hour test.

7. Low Pressure Air Testing

- a. PVC sanitary sewers 54-inch diameter and less may be air tested as specified. If the groundwater level is two (2) feet or more above the top of the pipe at the upstream end or if the air pressure required for the test is greater than 5 psig, the air test method should not be used for RCP sanitary sewers.
- b. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses. Backfill shall be brought to final grade before testing. Testing shall be done prior to surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
- c. Test equipment consists of valves and pressure gages to control airflow and to monitor pressure within the test section.
- d. The sewer shall be flushed and cleaned prior to testing to clean out any debris. The pipe surface should be wet for more consistent results.
- e. The section of pipe to be tested shall be plugged at each end and the ends of laterals, stubs and fittings to be included in the test section shall be plugged and securely braced to prevent air leakage, and possible blowouts.
- f. Equipment used shall meet the following minimum requirements and be approved by the Engineer:
 - 1) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
 - 2) Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - 3) All air used shall pass through a single control panel.
 - 4) Three (3) individual hoses shall be used for the following connections:
 - a) From control panel to pneumatic plugs for inflation.
 - b) From control panel to sealed line for introducing the low pressure air.
 - c) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- g. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used for the test. The sealed pipe shall be pressurized to 9 psig. The plugs must hold against this pressure without having to be braced. No persons shall be allowed in the alignment of the pipe during plug testing.
- h. After a manhole to manhole run of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be slowly introduced into this sealed line until the internal air pressure reaches

approximately 4 psig greater than the average groundwater back pressure, but not greater than 9 psig for PVC pipe or 5 psig for RCP.

- i. In areas where groundwater is known to exist, the Contractor must determine the average groundwater back pressure. The Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sanitary sewer lines entering the manhole. See Figure No. 1. This shall be done at the time the sanitary sewer line is installed or install an 8-inch diameter stand pipe outside of the manhole backfilled with a column of clean stone of 2-inch minimum diameter to subgrade. Immediately prior to the performance of the low pressure air test, the ground water back pressure shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be vertical and a measurement of the height, in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. This height, divided by 2.307, will equal the average groundwater back pressure.
- j. At least two (2) minutes shall be allowed for the air to stabilize when the specified internal air pressure has been obtained. When the pressure has stabilized and is at or above 3.5 psig, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average groundwater back pressure calculated) shall not be less than the time in the tables in Reference Table 1.
- k. If a one (1) psi drop in pressure does not occur within the test time, the line has passed. If the pressure drop is more than one (1) psi during the test time, the line is presumed to have failed the test. If the line fails the test, segmented testing may establish the location of any leaks.
- l. The Contractor must repair the leak or remove and replace the defective pipe section and re-test the section to the satisfaction of the Engineer at no additional cost to the Owner.
- m. The pneumatic plugs must be installed in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug, which is partially deflated before the pipe pressure is released, can be dangerous.
- n. The Contractor should internally restrain or externally brace the plugs to the manhole wall as an added safety precaution throughout the test.
- o. Pressurizing equipment shall include a regulator or relief valve set at no higher than 9 psig for PVC pipe or 5 psig for RCP pipe to avoid over-pressurizing and damaging an otherwise acceptable line.
- p. No one shall be allowed in the trench or manholes during testing.
- q. Plugs shall not be removed until all pressure has been released.
- r. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one hour test.
- s. The air test data sheet marked Exhibit "A" at the end of this section shall be filled out for each section of piping tested in this manner.

- t. Testing concrete pipe sewer lines by the low pressure air test method will be per ASTM C924-02 and C1103.
8. Hydrostatic Testing – Pressure Pipe
- a. The pipe to be tested must be sufficiently backfilled to prevent movement while under test pressure.
 - b. Joint restraint at fittings should be permanent and constructed to withstand test pressure. If concrete thrust blocks are used, sufficient time must be allowed before testing to permit the concrete to cure. A cure time of seven (7) days is recommended when Type I Portland Cement is used; three (3) days is recommended when Type III high-early Portland Cement is used.
 - c. Test ends should be restrained to withstand the appreciable thrusts that are developed under test pressure.
 - d. Air pressure testing of installed pressure pipe is expressly prohibited.
 - e. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.
 - f. The hydrostatic testing sheet marked “Exhibit D” following this section shall be filled out for each section of piping tested in this manner.
 - g. After the pipe is laid and before backfill is placed around the joints, such lengths of the force main as determined by the responsible agency shall be tested under a hydrostatic pressure of 1.25 times the working pressure at the highest point along the test section, but, in no case, shall such force mains be tested at less than 150 pounds per square inch.
 - h. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a booster pump connected to the pipe in a manner satisfactory to the Engineer. The duration of the test shall be for a minimum of sixty (60) minutes.
 - i. No pipe installation will be accepted unless the leakage rate for the section of pipe being tested does not exceed a rate as shown on hydrostatic test chart, during a 24-hour test duration.
 - j. The Contractor shall furnish suitable means for determining the quantity of water lost by leakage during the test.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 SEQUENCING AND SCHEDULING

- A. The Contractor shall coordinate the sequence of work activities so as to accommodate required testing and shall allow sufficient time for testing of materials by the laboratory so as to cause no delay in the work or the work of any other Contractor. In addition, the Contractor shall coordinate his work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests.

3.2 LABORATORY TEST RESULTS

- A. The testing laboratory shall submit a certified written report of each inspection, test, or similar service concurrently to the Owner, Engineer, and Contractor.
- B. Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:
 - 1. Name of testing laboratory.
 - 2. Project name and construction contract reference number.
 - 3. Dates and locations of samples and tests or inspections.
 - 4. Date of report.
 - 5. Names of individuals making the inspection or test.
 - 6. Designation of the work and test method.
 - 7. Test results.
 - 8. Notation of significant ambient conditions at the time of sample taking and testing.

END OF SECTION 013319

SECTION 013319.01 - FIELD TEST REPORTING

- AGGREGATE, SOILS, CONCRETE AND ASPHALT

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall be responsible for the quality of all materials incorporated into the project work and shall be responsible for all costs of testing and certification of same. The Contractor shall provide the City Engineer a list of three (3) local qualified firms for the City to select from to be the Contractor's testing firm.
- B. The Contractor shall provide the engineer with a Quality Control Plan in which his testing methods/procedures are defined. Said Plan shall meet with the approval of the Engineer and include identification of laboratories, types of testing, and the tentative amount and scheduling of each.

All certification of tests and/or gradations for material to be utilized in the work and all quality control testing shall be performed by an independent laboratory (not affiliated with, owned by, or managed by the Contractor). The laboratory shall be accredited by the AASHTO Materials Reference Laboratory for the type of testing performed.

- C. The Owner may perform field Quality Assurance testing; however, such testing shall not relieve the Contractor from the responsibility of Quality Control testing or from supplying certificates from manufacturers or suppliers to demonstrate compliance with the specifications. It is intended that the testing by the Contractor and the Owner be complimentary toward a quality project; however, the Contractor may not assume the Owner will test or that any tests will be done in lieu of the Contractor's own Quality Control testing. In the same sense, the Contractor may not rely on Owner Quality Assurance testing as a basis of acceptance or approval of his work nor may any Owner-performed testing be reflected in his submitted plan.

1.2 TEST CRITERIA

- A. The following tests at a minimum shall be included with the Contractor's Quality Control Plan in accordance with the specifications:
 - 1. Aggregates

- a. For each material and/or different source, the laboratory shall perform soundness, gradation, and other tests for all parameters specified. Aggregates incorporated into concrete or asphalt mixes shall also be tested for moisture content daily.

2. Compaction Tests

- a. Compaction tests or field density tests shall be taken on all embankment, trench backfill, subgrade, and subbase materials.

- b. Minimum testing shall be as follows:

Embankment testing shall be at least one (1) test/5,000 SF of each lift; Trench backfill testing shall be at least one (1) test/50 LF of each lift; Subgrade and/or subbase testing shall be at least one (1) test/200 LF of pavement or 5,00 SF of slabs; subject to greater frequency due to soil conditions or Engineer's direction.

- c. Proctors or relative density tests shall be performed as often as necessary for the differing soils or granular materials utilized. Proctors shall be run with a minimum of 5 points. Test reports shall show the wet (bulk) weight, dry weight, wet (bulk) density, dry density, moisture content weight and moisture content percentage. Both the dry curve and the wet curve shall be plotted.

3. Concrete Mix Design

- a. For each type of concrete, the laboratory shall perform the necessary mix design providing all test data as required by the specifications.

4. Concrete Field and Laboratory Tests

- a. The laboratory shall cast concrete cylinders and test beams:

- 1. One set of four cylinders per 50 CY with a minimum of two sets per day. The cylinders shall be broken: one at 7 days, two at 28 days, one at 56 days, unless otherwise directed by the Engineer.

- 2. One beam per 50 CY with a minimum of two beams per day.

- b. Temperature and unit weight shall be run on fresh concrete at intervals sufficient for the type of structure being placed and a minimum of once per day. Bulk weight, bucket weight, (tare), net weight, bucket factor (bucket volume) and unit weight shall be recorded on the fresh concrete report. Show all batch weights for yield calculations. Slump and air content tests shall be taken a minimum of one test per 20 CY and at least once per day.

- c. All field and laboratory testing shall be performed by technicians certified by the American Concrete Institute (ACI) for the type of testing performed.
- d. Initial cure of all cylinders shall be in a temperature controlled cure box or temperature controlled water tank with a hi-low thermometer. Hi-low temperature readings shall be recorded on the fresh concrete report.

5. Asphalt Mix Design

- a. For each type of asphalt mix, submit job mix formula (JMF) prepared by an ODOT pre-qualified laboratory from tests performed on the aggregates proposed for use.
- b. Sample and test for gradation and bitumen content per ODOT 441.

1.3 LABORATORY REPORTS

- A. Reports of laboratory and field tests will be distributed to the Engineer, Owner, and Suppliers within 24 hours of completion.

END OF SECTION 013319.01

SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 GENERAL

- A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.
- B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

- C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such a manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.
- D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.
- E. The Contractor shall submit Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions and as specified herein. Shop Drawings shall be submitted in

sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer/Architect.

- F. It is the responsibility of each Prime Contractor to furnish to all other Prime Contractors and especially the General Construction Contractor reviewed Shop Drawings for guidance in interfacing the various trades; i.e. sleeves, inserts, anchor bolts, terminations, and space requirements.
- G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.
- H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.
- I. The Engineer/Architect will review the first and second Shop Drawing item submittals at no cost to the Contractor. Review of the third submittal and any subsequent submittal will be at the Contractor's expense. Payment will be deducted from the Contract amount at a rate of 2.8 times direct labor cost plus expenses.

1.2 SUBMITTAL PROCEDURE

- A. All required submissions shall be made to the Engineer/Architect by the Prime Contractor(s) only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.
- B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.
- C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:
 - 1. Location
 - 2. Project Name
 - 3. Contract
 - 4. Name and Address of Engineer/Architect

5. Name and Address of Contractor
6. Name and Address of Subcontractor
7. Name and Address of Supplier
8. Name of Manufacturer
9. Number and Title of appropriate Specification Section
10. Drawing Number and Detail References, as appropriate.
11. Submittal Sequence or Log Reference Number.

- a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".

- D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

Signature

Date

Company

- E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.
- F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.
- G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.
- H. For product which require submittal of samples, furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

1.3 REVIEW PROCEDURE

- A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
- B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.
- C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.
- D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

- 1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
 - 2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
 - 3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
 - 4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.
- E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.

APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Page	Paragraph	Description

- A. The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.

- B. Change in Contract Price (indicate + or -) \$ _____

- C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.

- D. Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature:

Firm:

Address:

Telephone:

Date:

Attachments:

For use by ENGINEER:

Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

Accepted as evidenced by included CHANGE ORDER.

Not accepted as submitted. See Remarks.

Acceptance requires completion of submittal as required for SHOP DRAWINGS.

Not accepted. Do not resubmit.

By:

Date:

Remarks: _____

APPLICATION FOR USE OF “OR-EQUAL” ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Page

Paragraph

Description

- A. The undersigned requests consideration of the following as an “or-equal” item in accordance with Article 6.05 of the General Conditions.

- B. Change in Contract Price (indicate + or -) \$

- C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.

- D. Signature:

Firm:

Address:

Telephone:

Date:

Attachments:

For use by ENGINEER:

_____Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

_____Accepted as evidenced by included CHANGE ORDER.

_____Not accepted as submitted. See Remarks.

_____Acceptance requires completion of submittal as required for SHOP DRAWINGS.

_____Not accepted. Do not resubmit.

By:

Date:

Remarks: _____

END OF SECTION 013323

SECTION 013326 – PRODUCT TESTING AND CERTIFYING

PART 1 - GENERAL

1.1 QUALITY OF MATERIALS

- A. Where the specifications call for mill or shop tests, the Contractor shall furnish duplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to contract requirements. Mill, shop or witness tests shall be subject to view by the Engineer's representative, but the Engineer's representation shall not relieve the Contractor from the necessity of furnishing certificates specified. The Engineer shall be notified by the Contractor in writing, sufficiently in advance of the time of making tests, so that proper arrangements may be made. Waiving of witness of tests by the Engineer may be in writing only by the Engineer. All costs for travel, lodging, food and transportation that are necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be included in the Contractor's bid for those item(s) specifically designated as being subject to witness testing.
- B. Unless otherwise specified, all materials, equipment and articles shall be erected, installed, applied, or connected, used, cleaned and conditioned in accordance with the printed instructions and directions of the manufacturer.
- C. The installation shall be so made that its several component parts will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.
- D. The work shall be executed in conformity with the best practice and so as to contribute to efficiency of operation, minimum maintenance, accessibility and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment and usage.
- E. Whenever in the contract documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment is to be regarded merely as a standard and such trade name shall be followed by "or equal".

1.2 QUALITY ASSURANCE

- A. The equipment and materials to be furnished under this Contract shall be the products of well established and reliable firms which have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment which have been in successful operation for at least five (5) years.

1.3 EXPERIENCE CLAUSE REQUIREMENT AND PERFORMANCE BONDS FOR MANUFACTURER

- A. For every piece of equipment furnished under this Contract, the manufacturer will be required to have a minimum of five (5) years of experience in providing this specific type of equipment. In lieu of this experience requirement, the manufacturer will be required to provide performance bond(s) for the faithful performance of the equipment and guarantee payment in a sum of not less than one hundred and fifty percent (150%) of the total equipment price for the completed work for that item. In the absence of verifiable experience, the manufacturer will be required to provide the performance bond(s) for the same number of years that the manufacturer was found lacking in experience from the specified five (5) year period. The performance bond(s) shall be from an approved surety company, to the satisfaction of the Owner's Law Director.
- B. Agents of bonding companies which write bonds for the performance and payment of the contract shall furnish power of attorney bearing the seal of the company, evidencing such agent's authority to execute the particular type of bond to be furnished, and evidencing also the right of the surety company to do business in the State of Ohio. Copy of this proof shall be attached to each copy of the contract.
- C. The bond shall be purchased through a surety company with a local agent upon whom service of process can be made.
- D. In event of failure of surety or co-surety, the manufacturer shall immediately furnish a new bond, as required herein. The manufacturer's bond will not be released until all provisions of the contract have been fulfilled.
- E. The surety used for the bid bond and performance bond shall be listed in the latest U.S. Treasury Circular 570 and the Penal Sums shall be within the maximum specified for such company in said Circular 570.

END OF SECTION 013326

SECTION 013326.01 - QUALITY CONTROL PLAN

PART 1 - GENERAL

1.1 QUALITY CONTROL

- A. The Contractor shall be responsible for the quality of all materials incorporated into the project work and shall be responsible for all costs of testing and certification of same. The Contractor shall provide the Engineer a list of three (3) local qualified firms for the Village to select from to be the Contractor's testing firm.
- B. The Contractor shall provide the Engineer with a Quality Control Plan in which his testing methods/procedures are defined. Said Plan shall meet with the approval of the Engineer and include identification of laboratories, types of testing, and the tentative amount and scheduling of each.

All certifications of tests and/or gradations for materials to be utilized in the work and all quality control testing shall be performed by an independent laboratory (not affiliated with, owned by, or managed by the Contractor). The laboratory shall be accredited by the AASHTO Materials Reference Laboratory for the type of testing performed.

- C. The Owner may perform field Quality Assurance testing; however, such testing shall not relieve the Contractor from the responsibility of Quality Control testing or from supplying certificates from manufacturers or suppliers to demonstrate compliance with the specifications. It is intended that the testing by the Contractor and the Owner be complimentary toward a quality project; however, the Contractor may not assume the Owner will test or that any tests will be done in lieu of the Contractor's own Quality Control testing. In the same sense, the Contractor may not rely on Owner Quality Assurance testing as a basis of acceptance or approval of his work nor may any Owner performed testing be reflected in his submitted plan.

1.2 TEST CRITERIA

- A. The following tests at a minimum shall be included with the Contractor's Quality Control Plan in accordance with the specifications:

1. Aggregates

- a. For each material and/or different source, the laboratory shall perform soundness, gradation, and other tests for all parameters specified. Aggregates incorporated into concrete or asphalt mixes shall also be tested for moisture content daily.

2. Compaction Tests

- a. Compaction tests or field density tests shall be taken on all embankment, trench backfill, subgrade, and subbase materials.
- b. Minimum testing shall be as follows:

Embankment testing shall be at least one (1) test/5000 S.F. of each lift;

Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;

Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or /5000 S.F. of slabs; subject to greater frequency due to soil conditions or Engineer's direction.
- c. Proctors or relative density tests shall be performed as often as necessary for the differing soils or granular materials utilized. Proctors shall be run with a minimum of 5 points. Test reports shall show the wet (bulk) weight, dry weight, wet (bulk) density, dry density, moisture content weight and moisture content percentage. Both the dry curve and the wet curve shall be plotted. The source materials shall be tested for gradation, Atterberg limits, shore-hydrometer and moisture content.

3. Concrete Mix Design

- a. For each type of concrete, the laboratory shall perform the necessary mix design providing all test data as required by the specifications.

4. Concrete Field and Laboratory Tests

- a. The laboratory shall cast concrete cylinders and test beams:
 - 1) One set of four cylinders per 50 C.Y. with a minimum of two sets per day. The cylinders shall be broken: one at 7 days, two at 28 days, one at 56 days, unless otherwise directed by the Engineer.
 - 2) One beam per 50 C.Y. with a minimum of two beams per day.
- b. Temperature and unit weight shall be run on fresh concrete at intervals sufficient for the type of structure being placed and a minimum of once per day. Bulk weight, bucket weight, (tare), net weight, bucket factor (bucket volume) and unit weight shall be recorded on the fresh concrete report. Show all batch weights for yield calculations. Slump and air content tests shall be taken a minimum of one test per 20 C.Y. and at least once per day.

- c. All field and laboratory testing shall be performed by technicians certified by the American Concrete Institute (ACI) for the type of testing performed.
- d. Initial cure of all cylinders shall be in a temperature-controlled cure box or temperature-controlled water tank with a hi-low thermometer. Hi-low temperature readings shall be recorded on the fresh concrete report.

5. Asphalt Mix Design

- a. For each type of asphalt mix, submit job mix formula (JMF) prepared by an ODOT pre-qualified laboratory from tests performed on the aggregates proposed for use.
- b. Sample and test for gradation and bitumen content as per ODOT 441.
- c. Asphalt compaction, thickness, and temperature tests shall be performed during asphalt placement per ODOT Item 448.

1.3 LABORATORY REPORTS

- A. Reports of laboratory and field tests will be distributed to the Engineer, Owner, and Suppliers within 24 hours of completion.

END OF SECTION 013326.01

SECTION 013543 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 UNNECESSARY NOISE, DUST AND ODORS

- A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

1.2 SEWAGE, SURFACE AND FLOOD FLOWS

- A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all sewage, surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

1.3 WORK IN FREEZING WEATHER

- A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

1.4 POLLUTION CONTROL

- A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems. This work shall conform to all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NPDES Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work may consist of but not be limited to construction and continual maintenance of silt fence, bio bag filters, sedimentation traps, stilling basins, check dams, temporary seeding, temporary mulching, erosion mats and other means to clarify waters containing suspended materials from excavations, embankments, cleared and grubbed or stripped areas, stockpiles, well points, and disposal sites and shall be commensurate with the contractor's schedule, sequence of work, means and methods. If a SWPPP plan is not required for the project, the contractor shall at a minimum submit a plan of his proposed

erosion control prevention methods for approval by the Owner and/or other regulatory authorities having jurisdiction prior to starting any construction activities which may cause erosion.

- C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.
- D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 013543

SECTION 014126 – GENERAL REGULATIONS AND PERMITS

PART 1 - GENERAL

1.1 REGISTRATION

- A. All Contractors and subcontractors shall be registered with the Building Department having jurisdiction. Contact the Building Department for additional registration information.

1.2 PERMITS

- A. The Contractor shall apply for and pay for all permits from the Owner and/or other authorities having jurisdiction.
- B. The Contractor shall apply for all permits from the Owner and/or other authorities having jurisdiction. The Owner will waive all permit and inspection fees for permits under their jurisdiction; however, the Contractor must pay all permit and inspection fees for permits issued by other authorities having jurisdiction.

1.3 ARCHAEOLOGICAL DISCOVERIES

- A. Contractors and subcontractors are required under O.R.C. Section 149.53, to notify the Ohio Historical Society and the Ohio Historic Site Preservation Board of Archaeological Discoveries located in the project area, and to cooperate with those entities in archaeological and historic surveys and salvage efforts if such discoveries are uncovered within the project area.
- B. Contact:

Department Head
Resource Protection and Review
Ohio Historic Preservation Office
800 E. 17th Avenue
Columbus, Ohio 43211-2497
[614-298-2000](tel:614-298-2000)
- C. Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 014126

SECTION 014223 - INDUSTRY STANDARDS

PART 1 - GENERAL

1.1 ABBREVIATIONS

- A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

1.2 REFERENCE TO OTHER SPECIFICATIONS

- A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

1.3 CODES AND STANDARDS

- A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

SECTION 014323 – QUALIFICATIONS OF TRADESMEN

PART 1 - GENERAL

1.1 CHARACTER OF WORKMEN AND EQUIPMENT

- A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Engineer or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Engineer so orders, and shall not be re-employed unless express permission be given by the Engineer. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.
- B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 014323

SECTION 014523 – TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

- A. This Section includes general requirements for the conduct of testing, adjusting and balancing.

1.2 SUMMARY

- A. Testing, adjusting and balancing shall be performed in accordance with recognized industry standards and as specified in the Contract Documents.

1.3 RELATED DOCUMENTS

- A. Section 013323 – Shop Drawings, Product Data and Submittals
- B. Section 017516 – Starting of Systems / Commissioning

1.4 DEFINITIONS

- A. Dry Testing:

Dry Testing is performed by the Contractor without introducing either process material or other test material into the component, system, or unit process.

- B. Wet Testing:

Wet Testing is performed by the contractor utilizing test material in the component, system, or unit process. Process Tankage shall be filled with test material to operating level.

- C. Performance Testing:

Performance Testing is performed by the Contractor to demonstrate system performance in accordance with Contract Document requirements.

- D. Factory Testing:

Factory Testing is performance testing, operation testing, or documentation verification conducted in the production facilities, or specialized test facilities, of the equipment supplier. Such testing shall conform to the requirements of individual sections of the Contract Documents.

E. Field Testing:

Field testing is performance testing, operation testing, or documentation verification conducted in the field after installation, to provide comparison with the results obtained in the factory testing. All field testing shall be witnessed by the Contractor.

1.5 SUBMITTALS

A. Quality Control Submittals:

Test Reports shall be submitted to the Contractor within 48 hours of the completion, suspension, or termination of the test unless otherwise approved by the Contractor. Submit Test Reports per Section 013323 – Shop Drawings, Product Data and Submittals

B. Project Record Documents:

Test, adjustment and balancing data shall be recorded by the Contractor per the Specifications.

1.6 REGULATORY REQUIREMENTS

- A. The requirements of this Section are in addition to those specifications by Regulatory Agencies. Except as specification prohibited or modified by the Specifications, comply fully with all requirements of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. The Contractor shall supply all materials and equipment used in testing, adjusting and balancing.
- B. Materials and equipment used shall be of good quality and suitable for the intended service. The use of miscellaneous items found at the job site is not acceptable.
- C. Select capacity or range of test equipment to provide meaningful test results. Select pressure or differential pressure gauges so that test pressure is 50% to 75% of the gauge capacity.

2.2 FABRICATION

- A. The Contractor shall fabricate temporary equipment used in testing.

2.3 SOURCE QUALITY CONTROL

- A. All test instruments shall be calibrated to recognized standards, traceable to NBS standards, by the instrument manufacturer or a qualified independent calibration laboratory. Submit instrument calibration data for the Contractor's review prior to the test.

PART 3 – EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. Verify the equipment, component, or system is completely and correctly installed before beginning tests.
- B. Review the design and installation of the system or equipment to ensure that the proposed test will not result in a hazard to personnel or equipment.

3.2 PREPARATION

- A. Design, fabricate, and install test equipment before commencing the test.
- B. Where required by the Contract Documents, or when required by the Contractor, an approved representative of the manufacturer shall be on site to provide technical direction.
- C. Notify and obtain approval of the Contractor not less than 72 hours prior to each test. See Section 017516, Starting of Systems/Commissioning.

3.3 TESTING, ADJUSTING, AND BALANCING

- A. Dry Testing:
 - 1. All equipment and systems shall be tested, adjusted, aligned, lubricate, and balanced in accordance with the manufacturer's instructions prior to witnesses testing.
 - 2. Test individual components prior to testing the system of which they are a part.

B. Wet Testing:

1. Test all equipment and systems with a test material, such as potable water, rain water or lake water. If lake water is available, Contractor shall submit a State of Ohio, Temporary Water Withdrawal Facility Registration Form, with the Ohio Department of Natural Resources, Columbus, Ohio. Potable water shall be used to test potable waterlines. All costs, including materials and equipment, for delivery of the test material shall be at the Contractor's expense. Any cost to the Owner for test material shall be backcharged to the Contractor. Test materials obtained from the Owner are not guaranteed as to their pressure, quality or quantity available. Test each component or item of equipment to demonstrate compliance with the design criteria or range of criteria.
2. After testing, adjusting, and balancing, test all equipment and systems for a minimum of 72 hours under the design operating conditions utilizing test material.
3. Suspend or secure all tests in the event of test failures, or if hazardous conditions occur. Make repairs, replacements, or adjustments and re-start test in its entirety.
4. The Contractor will dispose of the test material to the approval of the Owner at no additional expense to the Owner.
5. The Contractor shall clean all equipment systems and structures upon conclusion of testing, unless otherwise directed by the Owner, at no additional expense to the Owner.

C. Factory Testing

1. Conform to the specific test requirements, as given in individual sections of the Project Manual.
2. If equipment or materials fail or if testing must be extended beyond the original approved duration due to additional testing required as a result of the appearance of defect in the work or if testing could not be completed or conducted as outlined in the approved schedule, the cost of such re-testing, including additional or extended conveyance and maintenance of the Owner shall be borne by the Contractor.
3. Delays to the Contractor's Detailed Construction Network as specified in the Contractor's Progress Schedule due to failed, delayed or extended testing and the need for subsequent re-testing shall not entitle the Contractor to an extension of the contract time or additional cost. If the scheduling of the re-testing causes any activities shown on the Contractor's Detailed construction network to fall behind schedule to the extent that specific milestones or completion dates are in jeopardy,

the Contractor shall prepare a recovery schedule and submit such to the Owner prior to the re-testing of the equipment.

D. Field Testing

1. Conform to the specific test requirements as given in individual sections of the Project Manual. Provide all necessary assistance to Owner personnel, at no additional cost to the Owner. All field testing shall be witnessed by the Owner.

3.4 FIELD QUALITY CONTROL

- A. Submit Test Reports for all tests, successful or unsuccessful in accordance with Section 013323 – Shop Drawings, Product Data and Submittals.
- B. Test shall be repeated per the General Conditions if results of testing fail to meet test criteria, whether the failure is identified in the field at the time of testing or through Test Report review.

END OF SECTION 014523

SECTION 015113 - TEMPORARY HEATING, LIGHTING AND POWER

PART 1 - GENERAL

1.1 APPLICABLE CONTRACTORS

- A. General Construction Contractor (Referenced as GCC or GC)

1.2 GENERAL CONSTRUCTION CONTRACTOR

- A. General Construction Contractor shall provide and/or install the following:

1. All costs of electrical current consumed by all Prime Contractors. The General Construction Contractor shall make arrangements with the local electric utility company to have the periodic bill sent directly to the General Construction Contractor.
2. Temporary heating system, as required, to protect the work until the work is complete and ready for occupancy by the Owner. Such system shall meet all requirements of the N.E.C., O.B.B.C. and the local codes for temporary construction services.
3. All costs of natural gas, propane, fuel oil, electric power or other energy consumed and costs related to provide temporary heat.
4. All piping necessary to provide fuel for the temporary heating system.
5. All ductwork and vents necessary for the temporary heating system.
6. Power
 - a. Temporary power facilities for construction purposes including the cost of running temporary service from the utility supply to the various project construction areas. Power shall be provided in accordance with the General Construction Contractor's construction schedule.
 - b. The electrical work for construction purposes shall conform to all Federal, State (Ohio Safety Code IC-3, Specific Safety Requirements) as well as requirements of the National Electric Code. The General Construction Contractor shall obtain and pay for required applications, permits and inspection pertaining to this work. This cost shall also be included in the General Construction Contractor's price.
 - c. All utility charges or fees for permits, step down transformers, metering or other materials.

- d. Temporary work shall be installed in such a manner as not to interfere with the permanent construction. If such interference does occur, it shall be the responsibility of the General Construction Contractor to make such changes as may be required to overcome the interference.
- e. The General Construction Contractor shall arrange for the installation of temporary service for construction purposes as well as making provisions to adequately protect the transformer and any associated temporary power equipment throughout the course of construction.

7. Heating

- a. The electrical facilities for temporary heating and ventilating systems. All temporary systems shall be connected directly to the project temporary power system.

8. Lighting

- a. Provide labor and material for the installation and maintenance of temporary light and power as may be required during the period of construction.

END OF SECTION 015113

SECTION 015136 - TEMPORARY WATER AND DISTRIBUTION

PART 1 - GENERAL

1.1 WATER

- A. The Contractor shall be responsible for an adequate supply of water suitable for his use for construction and drinking. At his own expense, he shall provide and maintain adequate supplies and supply lines in such locations and installed in such a manner as may be satisfactory to the Engineer.

END OF SECTION 015136

SECTION 015213 – FIELD OFFICES & FIRST AID

PART 1 - GENERAL

1.1 CONTRACTOR'S OFFICE

- A. Each Contractor shall provide and maintain an office on the site of the work during the construction period of the contract, at which he or his authorized agent shall be present at all times while the work is in progress. The office shall be equipped with air conditioning, heating, electric lighting clothes closet.
- B. A desk with locking drawer and chair shall be available for the exclusive use of the Resident Engineer while he/she is on site.
- C. Provide, maintain, and pay for a minimum 2MB high-speed internet service to field office for Resident Representative at time of project mobilization. This shall include a connection suitable for the resident engineer's laptop computer.

1.2 AID TO THE INJURED

- A. The Contractor shall keep in his office and on the work site, all articles necessary for giving "First Aid to the Injured." He shall also have standing arrangements for the immediate removal and hospital treatment of any employee or other person who may be injured on the work site.

END OF SECTION 015213

SECTION 015219 – TEMPORARY SANITARY FACILITIES

PART 1 - GENERAL

1.1 MAINTENANCE OF SANITARY FLOWS

- A. The Contractor for this contract shall be responsible for maintaining all sanitary flows through the existing sanitary sewerage systems. Provisions shall be made for temporary pumping and/or storage of sanitary flows during periods of sewer and manhole reconstruction, or when flows must be interrupted to make connections to the new facilities as directed by the Engineer.

END OF SECTION 015219

SECTION 015526 - TEMPORARY TRAFFIC CONTROL DEVICES

PART 1 - GENERAL

1.1 BARRICADES, SIGNS AND LIGHTS

- A. The Contractor shall employ watchmen on the work when and as necessary. The Contractor shall erect and maintain such strong and suitable barriers and such lights as will effectively prevent the occurrence of any accident to health, limb or property. Lights shall be maintained between the hours of one-half (1/2) hour after sunset and one-half (1/2) hour before sunrise.
- B. No manhole, trench, excavation will be left open awaiting connection or removal at a later date by the Contractor's forces or others but shall be temporarily backfilled and resurfaced if applicable with a temporary pavement passable to traffic at no additional cost to the Owner.
- C. In addition to other safety requirements, a minimum of four (4) foot high fence will be incorporated around any shaft or manhole or other excavation left open at the end of a day's work.

1.2 MAINTENANCE OF TRAFFIC

- A. The Contractor is required to provide maintenance of traffic in conformance with the Ohio Manual of Uniform Traffic Control Devices and Item 614 of the current Construction and Material Specifications of the Ohio Department of Transportation.
- B. This work shall include providing suitable and satisfactorily trained and properly attired flagmen for use at any location where existing roadway is narrowed to a width of less than 2 full lanes (18 feet).
- C. The Contractor is also responsible for maintaining local access to all residences and businesses along the route of the construction and to provide whatever temporary materials are necessary to provide a safe, adequate drive surface.
- D. At all boring locations, Contractor shall provide suitable flashers, barricades, and traffic control devices as may be deemed necessary by the Engineer or the responsible authority in the case of the Department of Transportation, Turnpike Commission, or affected railroad. This may extend to maintain facilities on a 24-hour basis until such time as the areas are completely backfilled.

END OF SECTION 015526

SECTION 015713 - TEMPORARY EROSION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnishing all labor, materials, tools, equipment and services for the temporary soil erosion and sediment control work as indicated.
- B. Coordinating the temporary pollution and erosion control with work of all other trades.
- C. Reducing to the greatest extent practicable the area and duration of exposure of readily erodible soils.
- D. Protecting the soils by use of temporary vegetation or mulch or by accelerating the establishment of permanent vegetation.
- E. Mechanically retarding the rate of runoff from the construction site and control disposal of runoff.
- F. Trapping all sediment resulting from construction in temporary or permanent debris basins.
- G. Using temporary measures to keep erosion under control if construction is suspended for any appreciable length of time.
- H. Providing protection against chemical, fuel, or lubricant spills, and sewage pollutants.
- I. Protecting project and existing structures from surface water damage due to utility line excavations.
- J. Controlling soil erosion and sedimentation by use of silt fences, dikes, ditches, slope protection, sediment pits, basins, dams, slope drains, coarse aggregate, mulches, sod, grasses, filter fabrics, and other erosion control devices or methods.

1.2 SUBMITTALS

- A. All submittals shall conform completely to the requirements of the Contract Documents.
- B. Site Plan showing:
 - 1. Vegetation removal limits.
 - 2. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.
- D. Reference Submittals

E. Material Certification

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling and Unloading.
1. Comply with Section 016600, Product Handling and Protection.
- B. Acceptance at Site.
1. Inspect all equipment and materials against reviewed Shop Drawings at time of delivery.
 2. Equipment and materials damaged or not meeting the requirements of the reviewed Shop Drawings shall be immediately returned for replacement or repair.
- C. Storage and Protection
1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
 2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the manufacturer's instructions.

1.4 SEQUENCING AND SCHEDULING

- A. All temporary control measures as shown on the Drawings, called for in these Specifications or ordered by the Engineer shall remain in effect during the life of the contract to control soil erosion, sedimentation and water pollution.

PART 2 - PRODUCTS

2.1 SEED

- A. Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America.
- B. All areas of temporary seeding shall be seeded with grass as shown in the following table:

March 1 - August 15	Per 1000	
	Square Feet	Per Acre
Oats	3 lbs.	4 bu.
Perennial Ryegrass	1 lb.	40 lbs.
Tall Fescue	1 lb.	40 lbs.

August 16 - November 1*	Per 1000	
	Square Feet	Per Acre
Rye	3 lbs.	2 bu.
Wheat	3 lbs.	2 bu.
Perennial Ryegrass	1 lb.	40 lbs.
Tall Fescue	1 lb.	40 lbs.

* After November 1, use mulch only

2.2 ORGANIC MULCH

- A. Select mulch material based on site requirements, availability of materials and availability of labor and equipment. The following are the minimum rates:

Rates			
Mulch	Per Acre	Per 1000 ft ²	Notes
Straw (temporary only)	2 tons	90 lbs.	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Wood Chips (permanent or temporary)	400 yds. ³	9 - 10 yds. ³	Apply approx. 3" deep. Treat with 12 lbs. of nitrogen per ton. Do not use on firm turf areas. Apply with mulch blower, chip handler, or by hand.
Bark Chips or Shredded Bark (temporary mulch only)	70 yds. ³	1½ - 2 yds. ³	Do not use in fine turf areas. Apply about ½" thick. Apply with a mulch blower or by hand.

2.3 FERTILIZER

- A. All fertilizer shall be manufactured from cured stock and organic sources. Chemical elements shall be accurately proportioned, uniformly mixed, and delivered to the site in factory-sealed containers fully labeled, bearing the name or trademark and warranty of the manufacturer. Commercial fertilizer for lawn sodding shall be dry or liquid compounds of 12-12- 12 analysis, meeting applicable requirements of State and Federal laws.

2.4 LIMESTONE

- A. All limestone shall be ground agricultural grade dolomitic limestone containing at least 10 percent magnesium oxide with a minimum total neutralizing power of 90, with at least 40 percent passing a No. 100 sieve and at least 95 percent passing a No. 8 sieve.

2.5 WATER

- A. All irrigation water shall be clean and free from injurious amounts of oil, acid, alkali, or other deleterious substances.

2.6 DITCH CHECKS

- A. Temporary ditch checks shall consist of coarse aggregate dikes.

2.7 INLET FILTERS

- A. Temporary inlet filters and silt fences shall be adequately supported as detailed on the drawings.

2.8 SLOPE DRAINS

- A. Temporary slope drains shall consist of pipe, coarse aggregate, riprap, rock channel protection, mats, plastic sheets or other materials approved by the Engineer. Sediment pits may be included as part of slope drain protection.

2.9 FILTER FABRIC

- A. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

Physical Property	Requirements
Filtering Efficiency	75% (min.)
Tensile Strength at 20% (max.) Elongation *	Extra Strength - 50 lbs./lin. in. (min.) Standard Strength - 30 lbs./lin. in. (min.)
Flow Rate	0.3 gal./sq.ft./min. (min.)
*Requirements reduced by 50 percent after 6 months of installation.	

- B. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0° F to 120° F.

2.10 BURLAP

- A. Burlap shall be 10 ounce per square yard fabric.

2.11 FILTER SUPPORTS AND REINFORCING

- A. Posts for silt fences shall be either 4" diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them.
- B. Stakes for filter barriers shall be 1" x 2" wood (preferred) or equivalent metal with a minimum length of 3 feet.
- C. Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42 inches in height, a minimum of 14 gauge and shall have a maximum mesh spacing of 6 inches.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

- A. The Contractor shall limit the surface area of erodible earth material exposed by clearing and grubbing; the surface area of erodible earth material exposed by excavation; borrow; and fill operations; and provide immediate permanent or temporary control measures to prevent contamination of adjacent streams or other areas of water impoundment. Such work will involve the construction of temporary ditch checks, filters, benches, dikes, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods necessary to control erosion and sedimentation.
- B. The Contractor shall incorporate all permanent erosion control features into the Work at the earliest practicable time. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. This will require the establishing of final grades as shown on the Drawings and application of agricultural limestone, commercial fertilizer, seeding and mulching or sodding . When directed by the Engineer, temporary fertilizer, seeding and mulching materials shall be used. In general, the Contractor shall temporarily seed all disturbed areas within seven (7) days if they are to remain dormant for more than forty- five (45) days. Permanent soil stabilization shall be applied to disturbed areas within seven (7) days after final grade is reached on any portion of the site.. Temporary control measures will be used when and as directed by the Engineer to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- C. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion control measures will be required between successive construction stages.
- D. The Engineer will limit the area of excavation, borrow and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finished grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Mulching, seeding, and other such permanent control measures shall be applied after completion of a vertical eight (8) feet of embankment or cut, unless otherwise directed by the Engineer. Should seasonal limitations or embankment make such coordination unrealistic, temporary erosion control measures shall be taken immediately.
- E. The Engineer may increase or decrease the allowable amount of surface area or erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project

conditions. Factors such as soil erodibility, slope, cut or fill height, exposed area contributing to a watercourse and weather will be considered in this determination.

- F. In the event of conflict between these requirements and pollution control laws, rules, or regulations or other Federal, State or local agencies, the more restrictive laws, rules or regulations shall apply.
- G. Temporary seeding areas shall be fertilized at a rate of 12-15 pounds per 1000 square feet of 10-10-10 or 12-12-12 analysis or equal.
- H. When directed by the Engineer, the seed bed shall be thoroughly watered to maintain adequate moisture in the upper four (4) inches of soil, necessary to promote proper root growth.
- I. When directed by the Engineer, temporary seeded areas shall be mowed when grass exceeds four (4) inches in height.
- J. Temporary erosion control features shall be acceptably maintained and shall subsequently be removed or replaced when directed by the Engineer.
- K. Removed materials shall become the property of the Contractor and shall be disposed of off the site at the Contractor's expense.

3.2 PERFORMANCE

- A. If, in the opinion of the Engineer and Owner, proper control of soil erosion and sedimentation is not being provided by the Contractor, the Owner may take all necessary steps to provide corrective measures and the cost of such services will be deducted from any money which may be due or become due the Contractor.
- B. Control work performed for protection of construction areas outside the construction site, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites shall be considered as a subsidiary obligation of the Contractor, with all necessary control costs included in the contract price.
- C. In the event that temporary erosion and sediment control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled, and are ordered by the Engineer, such temporary work shall be performed by the Contractor at his expense.

3.3 SILT FENCE

- A. The height of a silt fence shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).
- B. The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum six (6) inches overlap and securely sealed.

- C. Posts shall be spaced a maximum of ten (10) feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed six (6) feet.
- D. A trench shall be excavated approximately four (4) inches wide and four (4) inches deep along the line of posts and upslope from the barrier.
- E. When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least one (1) inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of two (2) inches and shall not extend more than 36 inches above the original ground surface.
- F. The standard strength filter fabric shall be stapled or wired to the fence, and eight (8) inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.
- G. When extra strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts with all other provisions of Subparagraph F above applying.
- H. The trench shall be backfilled and soil compacted over the filter fabric.
- I. Silt fences shall be removed when they have served their purpose, but not before the upslope area has been permanently stabilized.
- J. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
- K. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and the barrier is still necessary, the fabric shall be replaced promptly.
- L. Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.
- M. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

3.4 TEMPORARY MULCHING

- A. Application
 - 1. Mulch materials shall be spread uniformly, by hand or machine.

- a. When spreading straw mulch by hand, divide the areas to be mulched into approx. 1000 sq. ft. sections and place approx. 90 lbs. of straw in each section to facilitate uniform distribution.
- B. Mulch Anchoring
 1. Straw mulch shall be anchored immediately after spreading to prevent windblow. One of the following methods of anchoring straw shall be used:
 - a. Mulch anchoring tool
 1. This is a tractor-drawn implement (mulch crimper, serrated straight disk or dull farm disk) designed to punch mulch approximately two(2) inches into the soil surface. This method provides maximum erosion control with straw. It is limited to use on slopes no steeper than 3:1, where equipment can operate safely. Machinery shall be operated on the contour.
 - b. Liquid mulch binders
 1. Application of liquid mulch binders and tackifiers should be heaviest at edges of areas and at crests of ridges and banks, to prevent windblow. The remainder of the area should have binder applied uniformly. Binders may be applied after mulch is spread; however, it is recommended to be sprayed into the mulch as it is being blown onto the soil. Applying straw and binder together is the most effective method.
 2. The following type of binder may be used:
 - a.) Asphalt - any type of asphalt thin enough to be blown from spray equipment is satisfactory. Recommended for use are rapid curing (RC-80, RC-250, RC-800), medium curing (MC-250, MC-800) and emulsified asphalt (SS-1, MS-2, RS-1 and RS-2). Apply asphalt at 4 gal./1000 ft.², 600 gal./acre. Do not use heavier applications as it may cause the straw to "perch" over rills.
 - b.) Wood Fiber - wood fiber hydroseeder slurries may be used to tack straw mulch.
 - c. Mulch nettings
 1. Lightweight plastic, cotton or paper nets may be stapled over the mulch according to manufacturer's recommendations.
- C. Chemical Mulches
 1. Chemical mulches may be used alone only in the following situations:
 - a. Where no other mulching material is available.
 - b. In conjunction with temporary seeding during the times when mulch is not required for that practice.
 2. Chemical mulches may be used to bind other mulches or with wood fiber in a hydroseeded slurry at any time. Manufacturer's recommendations for application of chemical mulches shall be followed.

D. Nets and Mats

1. Nets may be used alone on level areas, on slopes no steeper than 3:1, and in waterways.
2. When mulching is done in late fall or during June, July and August, or where soil is highly erodible, net should only be used in conjunction with an organic mulch such as straw.
3. When net and organic mulch are used together, the net should be installed over the mulch except when the mulch is wood fiber. Wood fiber may be sprayed on top of the installed net.
4. Excelsior blankets are considered protective mulches and may be used alone on erodible soils and during all times of the year.
5. Other products designed to control erosion shall conform to manufacturer's specification and should be applied in accordance with manufacturer's instructions provided those instructions are at least as stringent as this specification.
6. Staples will be made of plain iron wire, No. 8 gauge or heavier, and will be six (6) inches or more in length.
7. Prior to installation:
 - a. Shape and grade as required the waterway, channel, slope or other area to be protected.
 - b. Remove all rocks, clods or debris larger than two (2) inches in diameter that will prevent contact between the net and the soil surface.
 - c. When open-weave nets are used, lime, fertilizer and seed may be applied either before or after laying the net. When excelsior matting is used, they must be applied before the mat is laid.
8. Laying the Net:
 - a. Start laying the net from top of channel or top of slope and unroll down-grade.
 - b. Allow to lay loosely on soil - do not stretch.
 - c. To secure net: Upslope ends of net should be buried in a slot or trench no less than six (6) inches deep. Tamp earth firmly over net. Staple the net every twelve (12) inches across the top end.
 - d. Edges of net shall be stapled every three (3) feet. Where two strips of net are laid side by side, the adjacent edges shall be overlapped three (3) inches and stapled together.
 - e. Staples shall be placed down the center of net strips at 3-foot intervals. Do not stretch net when applying staples.
9. Joining strips
 - a. Insert new roll of net in trench, as with upslope ends of net. Overlap the end of the previous roll eighteen (18) inches, turn under six (6) inches and staple across end of roll just below anchor slot and at the end of the turned-under net every twelve (12) inches.
10. At bottom of slopes
 - a. Lead net out onto a level area before anchoring. Turn ends under six (6) inches and staple across end every twelve (12) inches.
11. Check slots
 - a. On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every fifteen (15) feet. Insert a fold of net into a six (6) inch trench and tamp firmly. Staple at twelve (12) inch intervals across the downstream portion of the net.

12. Rolling
 - a. After installation, stapling and seeding, net should be rolled to ensure firm contact between net and soil.
13. All mulches should be inspected periodically, in particular after rainstorms, to check for rill erosion. Where erosion is observed, additional mulch should be applied. Net should be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, re- install net as necessary after repairing damage to the slope. Inspections should take place up until grasses are firmly established. Where mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface; repair as needed.

3.5 TEMPORARY SEEDING

A. Site Preparation

1. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application and anchoring.
2. Install the needed erosion control practices prior to seeding such as diversions, temporary waterways for diversion outlets and sediment basins.

B. Seedbed Preparation

1. Lime (in lieu of a soil test recommendation) shall be applied on acid soil (pH 5.5 or lower) and subsoil at a rate of 100 pounds per 1000 square feet or two tons per acre of agricultural ground limestone. For best results, make a soil test.
2. Fertilizer (in lieu of a soil test recommendation) shall be applied at a rate of 12-15 pounds per 1000 square feet or 500-600 pounds per acre of 10-10-10 or 12-12-12 analysis or equivalent.
3. Work the lime and fertilizer into the soil with a disk harrow, springtooth harrow or similar tools to as depth of two inches. On sloping areas, the final operation shall be on the contour.

C. Seeding

1. Apply the seed uniformly with a cyclone seeder, drill, cultipacker seeder or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed wheat or rye no deeper than one (1) inch. Seed ryegrass no deeper than one-fourth ($\frac{1}{4}$) inch.
2. When feasible, except where a cultipacker type seeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller or light drag. On sloping land, seeding operations should be on the contour wherever possible.

D. Mulching

1. Mulch shall be applied to protect the soil and provide a better environment for plant growth.
2. Mulch shall consist of small grain straw (preferably wheat or rye) and shall be applied at the rate of two tons per acre or 100 pounds (two to three bales) per 1000 square feet.

3. Spread the mulch uniformly by hand or mechanically so the soil surface is covered.
4. Mulch Anchoring Methods
 - a. Mechanical - use a disk, crimper or similar type tool set straight to punch or anchor the mulch material into the soil.
 - b. Asphalt Emulsion - apply at the rate of 160 gallons per acre into the mulch as it is being applied.
 - c. Mulch Nettings - use according to the manufacturer's recommendations. Use in areas of water concentration to hold mulch in place.

E. Irrigation

1. If soil moisture is deficient, supply new seedlings with adequate water for plant growth until they are firmly established. This is especially true when seedlings are made late in the planting season, in abnormally dry or hot seasons, or on adverse sites.

END OF SECTION 015713

SECTION 015800 - PROJECT IDENTIFICATION

PART 1 - GENERAL

1.1 PROJECT SIGN

- A. The Contractor shall be responsible for constructing, installing, maintaining and removing all project signs.
- B. The Contractor shall be responsible for obtaining all permits for project signs from any local authority having jurisdiction including the payment of fees, if any.
- C. The Contractor shall coordinate final design details (including color) with the Owner.
- D. The Contractor shall install one project sign at a location to be determined by the Owner.

END OF SECTION 015800

SECTION 016600 - PRODUCT HANDLING AND PROTECTION

PART 1 - GENERAL

1.1 DELIVERY AND STORAGE OF MATERIALS

- A. The Contractor shall be responsible for delivery and storage of all materials.
- B. The Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment. Deliveries of all construction materials and equipment should be made at suitable times.
- C. The Contractor shall store all materials required for the performance of this contract at sites designated by the Engineer.
- D. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.
- E. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.
- F. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.
- G. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

END OF SECTION 016600

SECTION 017516 - STARTING OF SYSTEMS/COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Section includes general requirements for the commissioning of the Work and start-up and operation of systems and equipment.

1.2 SUMMARY

- A. Starting, testing, and operating the completed Work including systems and equipment until Substantial Completion is achieved and operation of the completed Work including systems or equipment are accepted by the Owner. Contractor shall cooperate and coordinate with the Owner in the operation, maintenance, and adjustment of the Work.

1.3 RELATED SECTIONS

- A. Section 013323 – Shop Drawings, Product Data and Submittals
- B. Section 014523 – Testing, Adjusting and Balancing
- C. Section 017923 – Operational Demonstration
- D. Section 017933 – Instruction of the Owner's Personnel
- E. Section 017819 – Maintenance

1.4 DEFINITIONS

- A. Commissioning: Commissioning is the series of activities, or process, necessary to ensure that systems and equipment are designed, installed, functionally tested, started up and capable of being operated and maintained to perform in conformity with the design intent for the facility improvements. Commissioning includes, but is not limited to factory testing, field testing, dry testing, wet testing, performance testing, manufacturer's checkout, start-up, and Operational Demonstration.
- B. Factory Testing: Factory Testing is performance testing, operation testing, or documentation verification conducted in the production facilities, or specialized test facilities, of the equipment supplier. Such testing shall conform to the requirements of the individual sections of the Contract Documents.

"Witnessed" Factory Testing shall mean that the testing is witnessed by the Owner or his designated representative.

- C. Field Testing: Field Testing is performance testing, operation testing, or documentation verification conducted in the field after installation, to provide comparison with the results obtained in the Factory Testing.
- D. Dry Testing: Dry Testing is performed by the Contractor without introducing either process material or other test material into the component, system, or unit process.
- E. Wet Testing: Wet Testing is testing performed by the Contractor utilizing test material in the component, system, or unit process. Tankage shall be filled with test material to operating level.
- F. Performance Testing: Performance Testing is performed by the Contractor to demonstrate system performance in accordance with the Project Manual requirements.
- G. Manufacturer's Check-Out: Field inspection, testing, adjustments, and sign off by the approved representative of the Manufacturer, indicating that the component, system, or unit process meets the manufacturer's requirements.
- H. Start-Up: Narrowly defined as placing a component, system, or unit process on-line. Start-up can be a commissioning activity or a normal operating activity.
- I. Operational Demonstration: A commissioning activity performed by the Contractor wherein the Contractor operates and maintains a fully functional component, system, or unit process for a period of time after stable operation has been achieved.

1.5 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Field Installation Reports – Submit reports by Manufacturer's Representative in accordance with Paragraph 3.4 of this Section.
- B. Commissioning Documentation: Contractor shall prepare and submit all documentation for review and approval. The documentation shall include, but not be limited to, the following:
 - 1. Certification by the preparer that he/she is the person responsible for the data, and that the data is authentic and accurate.
 - 2. Certification by the Contractor or equipment or unit process systems supplier that the equipment or the unit process systems were operated continuously for the specified period and that the equipment or unit process systems operated in compliance with the specified operating conditions, parameters and performance: and that the equipment or unit process systems are suitable for Performance Testing.

3. Pertinent background information shall include, but not be limited to, the following:
 - a. Equipment or unit process systems Started-Up and Commissioned
 - b. Start-Up and Commissioning dates
 - c. Items or performance criteria tested clearly showing requirements and field data that verify requirements were met.
 - d. Names of witnesses for Start-Up and Commissioning.
 - e. Any repairs, corrections, or modifications required for the equipment or unit process systems to successfully complete Start-Up and Commissioning.
 - f. Loop diagrams accurately depicting the installed condition of instrumentation and controls.
 - g. Any other important background information.
4. Appendix
 - a. A summary of all data used in the calculation, including source, formulas with all terms defined.
 - b. Calculations for all data submitted, fully defined.
 - c. Copies of all raw field data sheets, including those indicating sampling point locations, and notes.
 - d. Production and/or operational data.
 - e. Calibration procedures and worksheets for sampling equipment.
 - f. Copies of calibration records for instrumentation.
 - g. PLC Ladder logic documented with comments.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. The Contractor shall inspect systems and equipment prior to each start-up and verify their readiness for start-up. Conditions hazardous to equipment or personnel shall be corrected by the Contractor prior to start-up of equipment.
 1. Start-up operations shall not proceed using temporary power or temporary instrumentation and control wiring. All electrical and control connections shall be permanent and complete, and all such electrical components and equipment fully functional.
 2. Use of repair parts during start-up operations shall not be permitted, except in such situations where the actual on-site verification of such repair parts' operability is specified.

3. The Contractor shall verify that all initial copies of the Maintenance and Operating Instructions have received an acceptable disposition as defined in Section 013323, and the only outstanding item is the field verification of the Instructions.
- B. On successful completion of Start-up, process flows and solids shall be used for commissioning the equipment and unit process systems to show the equipment and unit process systems function properly. Commissioning shall confirm the proper operation of the equipment and unit process systems with process fluids and process solids, adjustment shall be made, and the equipment or unit process systems shall be optimized and brought into compliance with design criteria in preparation for Operational Demonstration.
 - C. The Contractor shall coordinate all Start-up and Commissioning activities for equipment and unit processes. The Contractor shall develop a detailed start-up and commissioning plan that includes the following as a minimum:
 1. Description of the overall general start-up and commissioning process.
 2. List of equipment and unit process systems included for start-up and commissioning activities.
 3. Detailed start-up and commissioning sequence of activities.
 4. Listing of staff and responsibilities for activities.
 5. Contractor shall use a form that will be provided by the Owner.

3.2 PREPARATION

- A. Prior to start-up of equipment or systems, all necessary test equipment shall be in place and operable.
- B. Approved representative(s) of the Manufacturer and Contractor shall be present for the initial start-up of systems or equipment.
- C. The Contractor shall request permission to start-up equipment, including electrical gear, and notify the Owner using a standard Start-Up Request form.
 1. The Start-Up Request shall be submitted to the Owner a minimum of 72 hours before the scheduled start-up. Requests shall be made during normal working hours.
 2. The Contractor shall provide all information in the first Section of the Start-Up Request form.
 3. The Owner will indicate approval or disapproval of the request.
 4. Approval of the request is based solely on impact on plant operations. Approval does not relieve the Contractor of any responsibility for plant and personnel safety.

5. The Contractor shall obtain the approved Start-Up Request prior to the system or equipment start-up.
 6. If training is to be conducted in conjunction with the start-up this should be indicated on the Start-Up Request form. All requirements of Section 017933, Instruction of the Owner's Personnel must be met for training sessions.
 7. Start-ups performed at the direction of the Contractor, per paragraph 3.3(G) of this Section, do not require advance notification to the Engineer.
- D. Normal installation checks, such as for rotation, are not considered start-ups and do not normally require start-up notification. For all equipment and systems so designated in the Contract Documents, or so designated by the Engineer, such checks shall be under the supervision of the approved representative of the manufacturer, and shall be reviewed by the Engineer.
1. All electrical apparatus which is energized shall be clearly marked.

3.3 CONDUCT OF START-UP AND COMMISSIONING

A. Start-up:

1. All initial start-ups of equipment or systems shall be performed under the technical direction of the approved representative of the manufacturer.
2. Any lack of readiness of associated systems or failure of a system or equipment previously started prior to the date of Final Completion of the Project shall require additional initial start-up service to be performed, under the direction of the approved representative of the manufacturer.
3. The Contractor shall repair, replace or modify any equipment or system which fails to perform as specified in the Contract Documents. Such repair, replacement or modification of deficient work shall be performed under the terms of the General Conditions.
4. During the Operational Demonstration period per Section 017900, Operational Demonstration and at other times when the system is on-line and an integral part of the Wastewater Treatment Plant operations and process, start-ups shall be performed as required by the Contractor.

- B. The Contractor shall be responsible for commissioning all work. Final acceptance shall be by the Owner.
- C. The Contractor is responsible for the performance and operation of the systems and equipment during commissioning.

- D. When Owner personnel are operating systems or equipment, the Contractor shall make available, at all times, persons knowledgeable about the systems or equipment to direct the Owner personnel in its operation.
- E. The Contractor shall make all adjustments and corrections necessary to achieve normal, stable operation of systems. Adjustment and corrections shall be in accordance with Sections 014523, Testing, Adjusting, and Balancing and 017819, Maintenance.
- F. Any failures of equipment or systems operated under the direction of the Contractor shall be considered deficiencies and shall be corrected in accordance with the General Conditions.
- G. During the Operational Demonstration period as defined in Section 017923, Operational Demonstration and at other times, the work will be on-line and an integral part of the Wastewater Treatment Plant operations and process. The Owner maintains control of Wastewater Treatment Plant operations and processes at all times. Therefore:
 - 1. The Contractor shall not commence, resume, terminate, or suspend the operations without the permission of the Owner and only in a sequence and manner suitable to the Owner.
 - 2. The Contractor shall immediately, on a 24 hour per day, 7-day per week basis, adjust or repair any malfunction in the work which in the opinion of the Owner jeopardizes or may jeopardize the proper operation of the Wastewater Treatment Plant.
 - 3. The Contractor shall not start-up, shut down, adjust, or otherwise alter the operation of any component, system, or unit process without the permission of the Owner except in the case of an emergency and in accordance with the General Conditions.

3.4 QUALITY CONTROL

- A. Reports of the Approved Representative of the Manufacturer:
 - 1. The approved representative of the manufacturer shall prepare a daily report on each site visit for each system or item of equipment inspected, adjusted, started-up, or worked on.
 - 2. The report shall state the purpose of the visit, the representative's observations and conclusions, and recommendations for further visits or action.
 - 3. The reports shall be submitted in accordance with Section 017800, Final Compliance and Submittals within 3 days of the visit.

END OF SECTION 017516

SECTION 017719 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Project record documents.
- E. Operation and maintenance data.
- F. Spare parts and maintenance Products.
- G. Warranties and bonds.
- H. Maintenance service.

1.2 RELATED SECTIONS

- A. Section 017821 – Cleaning and Protection
- B. Section 017516 – Starting of Systems

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
- B. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.4 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Tear down and remove all temporary structures; remove all construction equipment, excavated materials, and surplus materials; repair and replace all parts of existing embankments, fences or other structures which were removed or damaged during construction; restore and clean all channels, drains, manholes, and miscellaneous appurtenant structures; remove all rubbish; and put the site generally in a neat and orderly condition.

- C. Remove waste materials and broom clean buildings, wash windows and glazed doors and remove all dirt, excess paint and putty. Clean, wax and polish tile floors.
- D. Clean debris from roofs, gutters, downspouts, and drainage systems.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 ADJUSTING

- A. Adjust operating equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress. Meet weekly with Resident Representative or Owner to record information.
- E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities, piping, valves, and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities, piping, valves, and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
- G. Submit documents to Engineer.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS, SCIOTO VALLEY REGIONAL WRF, OHIO".
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, major equipment suppliers and nearest component service organization who can supply parts and service.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. Complete descriptive literature and drawings of all material furnished. This to include "record" wiring diagrams of all electrical equipment, "record" erection drawings providing up-to-date information on the actual construction of the equipment furnished and documentation of any field modifications made during installation, start-up and testing.
 - c. List of equipment.
 - d. Parts list for each component.
 - e. Operating instructions.
 - f. Maintenance instructions for equipment and systems including manufacturer's instructions for lubrication.
 - g. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - h. Installation, operation and maintenance brochures from the original manufacturers of all mechanical components such as valves, pipe couplings, instruments, etc., incorporated into the completed installation.
 - i. All required assembly, installation, alignment, leveling, adjustment and check-out instructions.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Equipment and system test reports including pump performance curves, blower performance curves, air and water balance reports.
 - c. Manufacturer's certificate that equipment is properly installed and ready for operation.
 - d. Photocopies of warranties.

- E. Submit 1 draft copy of completed volumes 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
- F. Submit three sets of revised final volumes to the Owner and one set to the Engineer, within 15 days after final inspection.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Provide spare parts, maintenance, and extra Products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment by Owner.

1.9 WARRANTIES AND BONDS

- A. Provide duplicate notarized copies.
- B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble in three ring binder with durable plastic cover.
- D. Submit prior to final Application for Payment.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.10 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections for one year from date of Substantial Completion.
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

PART 2 - PRODUCTS

- A. Per contract consideration.

PART 3 - EXECUTION

- A. Per contract consideration.

END OF SECTION 017719

SECTION 017800 - FINAL COMPLIANCE AND SUBMITTALS

PART 1 - GENERAL

- 1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.
- A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).
 - B. Contractor's Certification of Completion.
 - C. Contractor's Affidavit of Prevailing Wage.
 - D. Consent of Surety Company for Final Payment.
 - E. Affidavit of Final Acceptance Date and Correction Period.
 - F. Before the OWNER will approve and accept the work and release the retainer, the CONTRACTOR will furnish the OWNER a written report indicating the resolution of any and all property damage claims filed with the CONTRACTOR by any party during the construction period. The information to be supplied shall include, but not be limited to, name of claimant, date filed with CONTRACTOR, name of insurance company and/or adjuster handling claim, how claim was resolved and if claim was not resolved for the full amount, a statement indicating the reason for such action.
 - G. DBE Subcontractor Participation Forms USEPA.DBE.5 to 6 - FORM 6100-2 (DBE Subcontractor Participation Form).
 - H. American Iron and Steel Step Certification
 - I. Build America, Buy America Certifications

END OF SECTION 017800

SECTION 017819- MAINTENANCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section provides general requirements for the maintenance of equipment in the field. Storage maintenance requirements are provided by Section 017819, Product Handling and Protection. Specific maintenance requirements are provided by manufacturers per individual Sections in the Project Manual.
- B. Maintenance is performed to ensure delivery to the Owner of equipment in an undeteriorated and fully serviceable condition.
- C. This Section also includes requirements for preventive and corrective maintenance during operation of the equipment prior to the commencement of the Warranty period.

1.2 RELATED SECTIONS

- A. Section 016600, Product Handling and Protection.

1.3 DEFINITIONS

- A. Storage maintenance consists of establishing and maintaining the environment required by the stored materials and performing periodic servicing.
- B. Preventive maintenance consists of activities performed on a periodic basis to maintain operating or operational items or equipment.
- C. Corrective maintenance consists of correcting faults or failures in an item or equipment. This may include adjustments or replacement of defective parts.

1.4 SUBMITTALS

- A. The Maintenance Log shall be submitted to the Owner upon completion of the Operational Demonstration and before the start of the Warranty period.
- B. No submittals are required by this Section, except as noted above. Maintenance schedules and practices shall conform to approved submittals required by individual Sections in the Project Manual.

PART 2 – PRODUCTS

2.1 COMPONENTS, ACCESSORIES AND REPAIR PARTS

- A. All components, accessories and repair parts used in maintenance shall be supplied by or approved by the equipment manufacturer for use on the equipment.

2.2 SOURCE QUALITY CONTROL

- A. All parts and materials used in maintenance shall meet the quality control requirements provided for the item or equipment. These are specified in individual Sections of the Project Manual.

PART 3 – EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. The Contractor shall prepare a Maintenance Log for all equipment.
 - 1. This log shall include a list of required maintenance services and inspections, as provided by the manufacturer and submitted under individual Sections of the Project Manual.
 - 2. The Maintenance Log shall include checklists for the periodic services and inspections required.
 - 3. The Contractor shall initial and date the requisite log entries upon completion of the individual servicing or inspection.
 - 4. The Maintenance Log shall be located in the Contractor's Field Office and shall be available for review by the Owner until it is submitted for record purposes upon completion of the Operational Demonstration and the start of the Warranty period.

3.2 PREPARATION

- A. Before removing an item from storage per Section 017819, the Contractor shall review the installed location. Protection and services at the installed location must meet the equipment storage requirements.
- B. Before moving equipment to the installed location, the Contractor shall have available materials for temporary shelter or services required to establish the proper storage environment after the equipment is installed until it is placed in service in its final operating environment.

3.3 PERFORMANCE OF MAINTENANCE

- A. The Contractor shall perform all storage and preventive maintenance and inspections required by the manufacturer at the specified intervals.
- B. When notified by the Owner, the Contractor will perform corrective maintenance. This will be performed at no cost to the Owner. Corrective maintenance will be performed per manufacturer's written instructions or by direction of the approved representative of the manufacturer.
- C. The Contractor shall restore equipment to its operating condition before start-up.
- D. The Contractor shall re-establish storage maintenance in the event an item or equipment is removed from service.
- E. When the equipment warranty becomes effective, the Owner will assume responsibility for its maintenance.

END OF SECTION 017819

SECTION 017821 - CLEANING AND PROTECTION

PART 1 - GENERAL

1.1 GENERAL

- A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.
- B. As circumstances require and when ordered by the Engineer, the Contractor shall clean the road, driveway, and/or sidewalk on which construction activity under this contract has resulted in dirt or any other foreign material being deposited with an automatic self-contained mechanical sweeper with integral water spray, vacuum and on-board or supplementary containment.
- C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.
- D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.
- E. The Contractor shall wash all windows and other glass surfaces, leaving all areas free from putty marks, paint, etc.
- F. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 017821

SECTION 017823 – MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance information shall be submitted for all manufactured items, i.e. equipment, hardware, pumps, valves, motors, etc.
- B. This manual will either contain or make reference to all information that has been issued during the construction and start-up periods, as well as information necessary for the proper operation and maintenance of equipment.
- C. It shall be the responsibility of the Contractor who supplies such equipment to obtain from his vendors the required information and submit to the Engineer. This information will be accepted only if properly identified and only after it has been revised, where necessary, to conform to previous transmittals of the same material that have been "approved as noted" by the Engineer. All submittals shall be on 8-1/2" X 11" size paper or folded to that size.
- D. In general, and where applicable, the information shall consist of, but not be limited to, six (6) sets of the following:
 - 1. Descriptive literature, bulletins or other data covering equipment or system.
 - 2. Complete list of equipment and appurtenances included with system, complete with manufacturer and model number.
 - 3. Utility requirements.
 - 4. General arrangement drawing.
 - 5. Sectional assembly.
 - 6. Dimension print.
 - 7. Materials of construction.
 - 8. Certified performance curve.
 - 9. Performance guarantee.
 - 10. Parts list.
 - 11. Recommended spare parts list with part and catalog number.
 - 12. Lubrication recommendations and instructions.

13. Schematic wiring diagrams.
14. Schematic piping diagrams.
15. Instrumentation data.
16. Drive dimensions and data.
17. Control data.
18. Operating instructions.
19. Maintenance instructions including troubleshooting guidelines and preventative maintenance instructions with task schedule.
20. Required tools and equipment for operation and maintenance.
21. Safety considerations for O & M procedures.

END OF SECTION 017823

SECTION 017836 - WARRANTY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section provides procedures and requirements for warranting the Work. The enumerated warranties herein are in no way intended to abrogate any implied warranties as associated with goods supplied under this Contract.

1.2 SUMMARY

- A. Work Included:
 - 1. Preparation of Warranties for submittals.
 - 2. Requirements for the content and submittal of Warranties.

1.3 RELATED DOCUMENTS

- A. This Section includes minimum requirements for the warranty of the equipment. See also all equipment specification sections for additional requirements.
- B. Section 013323 - Shop Drawings, Product Data and Samples.

1.4 DEFINITIONS

- A. Owner: Village of Piketon
- Contractor: The Contractor, equipment manufacturer, the equipment supplier and any subcontractor's or suppliers
- Engineer: CT Consultants, Inc., or its subconsultants

1.5 SUBMITTALS

- A. As a part of the submittals for each item of equipment or a group of equipment items, include a DRAFT Warranty containing all of the language and terms specified.
- B. Following completion of the terms for establishment of the Warranty specified, prepare Warranties for submittal per section 013323 and the following:

1. Warranties for projects or portions of the work, established on a particular date as specified herein, may be submitted as a group.
2. Label each submittal with the title ‘WARRANTY,’ the project name and effective date; the Contractor’s names, address and telephone number.
3. A Table of Contents shall be included identifying each item with a number and title of specification section and the name of the product or Work item.
4. Separate Warranty for each specification section item with index tab sheets. Label tables to conform to the Table of Contents.

C. The Warranty shall contain, as applicable:

1. Effective starting date and end date of the Warranty period.
2. Statement of the terms and conditions of the Warranty, if any.
3. Statement that all Operating and Maintenance information has been provided and approved.
4. Statement that all training and training materials have been provided and approved.
5. Statement that the equipment or system commissioning is complete and has been reviewed and accepted by the manufacturer in accordance with provisions of the individual Sections in Divisions 2 through 16 of the Project Manual, as applicable.
6. Certifications by the Contractor and/or Manufacturer that the statements noted above are true and correct. This certification shall be signed by a person authorized to sign documents on behalf of the Contractor.

D. Special warranties, as required by individual Sections in Divisions 2 through 48 of the Project Manual, shall be submitted in accordance with the requirements of this Section.

PART 2 – PRODUCTS

2.1 WARRANTIES

A. Term or Period

1. The Warranty shall be for one (1) calendar year from the date of acceptance by Owner unless a longer period is required in the provisions of the individual Sections in Divisions 2 through 48 of the Project Manual, as applicable.

B. Contractor's Responsibilities

1. During the Warranty period, the Contractor is responsible for repair or replacement of all failures and defects, exclusive of ordinary and routine maintenance and failures directly traceable to the lack thereof. This requirement shall be thoroughly explained by the Contractor to all prospective equipment suppliers. Repairs or replacement shall be performed in accordance with the General Conditions.

PART 3 – EXECUTION

3.1 EXECUTION OF WARRANTY

- A. The approved DRAFT Warranty will be executed and placed in effect as the FINAL Warranty on the date of Final Completion of the Work for the specific equipment item or group named in the Warranty.

END OF SECTION 017836

SECTION 017839 - PROJECT RECORDS, DRAWINGS

PART 1 - GENERAL

1.1 RECORD DRAWINGS

- A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.
- B. The Contractor shall furnish dimensioned drawings indicating locations of all underground mechanical and electrical facilities.

1.2 SERVICE CONNECTION RECORDS

- A. The Contractor shall record the location of all service and property connections, new or existing, made to utilities constructed under this contract. Such records shall be turned over to the Owner upon completion of the work. The cost of making such records shall be included in the various unit or lump sum prices stipulated for the various items of the work.
- B. The location of each sewer connection as measured along the sewer from the nearest downstream manhole and its description with respect to the sewer shall be recorded. The record shall include the depth of new stubs for future connections and the depth of existing connections as measured from the surface grade. Also, the use of any vertical riser pipe shall be noted.
- C. The location of each water connection as measured along the water line from the nearest fire hydrant.

END OF SECTION 017839

SECTION 017900 – OPERATIONAL DEMONSTRATION

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

A. Work Included:

A demonstration of the operation of all systems is required. This Operational Demonstration shall be conducted, coordinated and recorded by the Contractor in accordance with the requirements specified herein.

1.2 SUMMARY

A. Section Includes:

1. Requirements for the conduct and reporting of the Operational Demonstration. This work is additional to any other installation, shop and factory testing, field testing, dry testing, wet testing, performance testing, balancing, or adjustments required elsewhere in the Contract Documents.

1.3 RELATED SECTIONS

- A. Section 017516 – Starting of Systems/Commissioning
- B. Section 014523 – Testing, Adjusting and Balancing

1.4 DEFINITIONS

- A. Operational Demonstration is defined in Section 017516, Starting of Systems/Commissioning.
- B. Operational Demonstration Log: A chronological record of the status of the system and equipment during the Operational Demonstration. All changes in status or system parameters, adjustments, and results of tests shall be included. Entries shall be made, noting the date and time, at the occurrence of each event. Operational Demonstration Logs shall be on a form acceptable to the Owner.

1.5 SUBMITTALS

A. Quality Control Submittals:

1. Test Reports:
 - a. Operational Demonstration log per subparagraph 3.4.A of this Section.
 - b. Report of Operational Demonstration per subparagraph 3.4.B.2 of this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

A. Before beginning the Operational Demonstration, the Contractor shall verify that:

1. All required construction activities are completed, including any activities by any entity that would interrupt the normal operations of the system. Coordinate with the Owner to resolve such conflicts.
2. All required testing, adjusting, and balancing is completed in accordance with Section 014523, Testing, Adjusting and Balancing.
3. Adequate parts and supplies for routine maintenance and replacement are on hand to support system operation through the demonstration period.
4. Start-up of equipment and systems per Section 017516, Starting of Systems/Commissioning has been completed.
5. All Repair Parts and Maintenance Materials have been delivered to the Owner.
6. Certain Instruction of Operating Personnel (training) has been scheduled to take place during the Operational Demonstration where specified. All other training will occur within 45 days prior to initiation of Operational Demonstration. The training of Operations Personnel shall be scheduled to take place during the first half of the

demonstration period, and the remaining training of Electrical, Instrumentation and Maintenance Personnel shall be scheduled to be complete before the end of the Operational Demonstration.

7. The field verification of the Initial Maintenance and Operating Inspections has been completed in accordance with the Specifications.

3.2 PREPARATION

- A. The Contractor shall provide two (2) representatives, a prime and an alternate, who will be responsible for the Operational Demonstration. These representatives will:
 1. Demonstrate the operation of systems and equipment to the Owner's operating personnel.
 2. Direct maintenance and repair work, by either the Contractor or the approved representative of the manufacturer of the system components and equipment.
 3. Maintain a log of the Operational Demonstration, as described herein.
 4. Be available at all times during the Operational Demonstration to perform these duties.
- B. Submit start-up notification to the Owner per Section 017516, Starting of Systems/Commissioning.

3.3 OPERATIONAL DEMONSTRATION

- A. The Contractor shall perform an Operational Demonstration of the work. Unless otherwise specified, the Operational Demonstration shall be a continuous 30-day, (720 hours) period during which the work is operated and maintained in a continuously on-line, fully functional process status.
- B. The Operational Demonstration shall encompass the entire work, or the portion thereof designated for Substantial Completion.
- C. Filling, draining, heating or cooling to temperature, stabilizing, adjusting, or other start-up activity time shall not be counted as Operational Demonstration time.
- D. During the Operational Demonstration period, the Contractor shall provide 24 hour per day, 7 days per week on-site supervision, in addition to the requirements of supervision as stated in the General Conditions. The Contractor shall provide labor and sufficient material to fully operate and maintain the work 24 hours per day, 7 days per week.

- E. When systems are on-line, conform to the requirements of Section 017516, Starting of Systems/Commissioning, Paragraph 3.3(G) for alterations in the Wastewater Treatment Plant processes.
- F. During the first half of the Operational Demonstration of the system and equipment, Owner personnel will observe the Contractor's personnel operating systems and equipment. The Contractor shall cooperate with this familiarization process.
- G. After the first 15 days of Operational Demonstration of system and equipment, operation of equipment will be assumed by the Owner personnel, under the direction of the Contractor, as described in Section 017516, Starting of Systems/Commissioning.

The Owner remains in control of the plant processes per Section T01650, Starting of Systems/Commissioning. The Contractor shall provide technical direction in the operation of equipment and systems.

- H. Start-up and operation of the system and all associated equipment shall be in accordance with the Initial Maintenance and Operating Instructions which have received an acceptable disposition from the Owner. If deviations from these instructions are necessary, these shall be noted in the Operational Demonstration Log, and subsequently submitted as revisions to the Maintenance and Operating Instructions. During the period of time between the completion of the Operational Demonstration and the Date of Substantial Completion, the system and equipment will be operated and maintained under the requirements of the second half of the Operational Demonstration. The Owner will not assume full responsibility for maintenance of the system and equipment until all conditions for Substantial Completion have been satisfied and both the Contractor and Owner have accepted the Certificate of Substantial Completion.
- I. All required maintenance and servicing prior to the Date of Substantial Completion shall be performed by the Contractor at the specified interval and as necessary. All maintenance and servicing shall be noted in the Operational Demonstration Log.
- J. All outages of equipment, system(s), or the plant should be noted in the Operational Demonstration Log. Plant outages are considered a part of normal plant operation and will not invalidate the Operational Demonstration. The Contractor is responsible for the safe and orderly shutdown and restart of equipment as necessary in the event of an outage. Outage time is not to be included in the Operational Demonstration period.
- K. The Contractor shall attend operational coordination meetings as called by the Owner to review operating conditions of equipment and systems.
- L. If, during the Operational Demonstration, any part of the work fails to fully conform to the requirements of the Contract Documents, the Operational Demonstration shall be considered to have failed, and the work shall not be considered to be Substantially

Complete as defined in the General Conditions and the Owner shall so notify the Contractor in writing. If, during the Operation Demonstration, the provisions of the General Conditions are evoked to stop the work, the Operational Demonstration will also be considered to have failed.

- M. Upon failure of the Operational Demonstration, the Contractor shall promptly remedy any defects in the work and shall promptly reschedule and re-start the complete 30 day, (720 hours) Operational Demonstration time period. No Operational Demonstration time will be considered to have accrued to any part of the work by reason of a failed Operational Demonstration.
- N. During the Operational Demonstration, the Owner may require or permit the Operational Demonstration to be suspended:
 - 1. As provided in the General Conditions.
 - 2. Upon the written request of the Contractor to correct or adjust the work when in the judgment of the Owner such required correction or adjustment is insufficient to deem the Operational Demonstration to have failed.
 - 3. If the Operational Demonstration is suspended for any reason except failure, Operational Demonstration time shall accrue to the work from the time of the beginning of the Operational Demonstration to the time of the suspension.

3.4 REPORTING

- A. Daily: Copy of the Operational Demonstration Logs shall be submitted to the Owner by 9:00 a.m. the following day.
- B. Within two (2) weeks of the termination or completion of the Operational Demonstration, the Contractor shall submit for approval:
 - 1. Any changes to the Maintenance and Operating Instructions.
 - 2. A report of the Operational Demonstration, describing the equipment utilized and any repairs, modifications, adjustments, or other work performed during the demonstration period.
- C. In the event the conduct of the Operational Demonstration or the submittals are unacceptable to the Owner, the Contractor shall perform the additional work or demonstrations required per the General Conditions.

END OF SECTION 017900

SECTION 017933 – INSTRUCTION OF OWNER'S PERSONNEL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General requirements for the conduct of training of permanent plant operating personnel on the care, maintenance and proper operation of the equipment. Specific requirements for training materials and for training are included in the individual Sections of the Contract Documents.

1.2 SUMMARY

- A. Work Included:

Except as otherwise specifically provided in individual Sections of the Project Manual, work under this Section includes the preparation of the detailed lesson plans and the conduct of detailed training for permanent plant operating personnel. Training shall be conducted on all components of equipment, as specified in individual Sections of the Project Manual.

- B. Training sessions and hours for all equipment specified as requiring training shall be per the manufacturer's recommendations. However, in no case shall the number of sessions be less than two (2) to accommodate multiple shifts. Sessions shall cover maintenance, operations and electrical.

1.3 RELATED SECTIONS

- A. Section 013323 – Shop Drawings, Product Data and Submittals
- B. Section 017923 – Operational Demonstration

1.4 DEFINITIONS

- A. Lesson Plan:

A Lesson Plan is a submittal containing a statement of the instructional objectives of the training, a training outline, credentials of the instructor, audio/visual requirements, a listing of training materials to be used, and the desired schedule times and dates.

- B. Training Aid:

A mock-up, model, sample, or other device used during a training class to help demonstrate the maintenance, operation, or control of equipment.

1.5 SUBMITTALS

- A. Submittal of Instructor's credentials, Lesson Plans, instructional materials, training aids, and other training information shall be coordinated with the Training Schedule.
- B. Enough copies of instructional materials used for training for everyone present shall be provided at the time of the first training session.
- C. Provide two copies of all audio/visual aids utilized during training including films, slides, mock-ups, videotapes, DVDs or other training aids. All multimedia video shall be submitted in either Audio Video Interleave (AVI) format or Moving Pictures Expert Group (MPEG) format.
- D. Submit the following:
 - 1. Proposed training Schedule for the entire Contract showing tentative dates for each training session: include number, type and duration of each session. This schedule shall be submitted 120 days prior to the commencement of any individual training being performed.
 - 2. The detailed credentials of the representative of the equipment manufacturer who is to be the course Instructor for each category and type of training. Include Instructor's name, education, knowledge of equipment, experience as a trainer and employment history with the manufacturer. Include specific details of Instructor's experience pertaining to the operation and maintenance of, the training for, the equipment or system specified. These credentials shall be submitted 60 days prior to the commencement of any training.
 - 3. The Lesson Plan shall be submitted sixty (60) days prior to the commencement of any training and shall cover all components of equipment, regardless of source of supply or manufacturer, and shall include:
 - a. A title page containing: Title of the Lesson Plan, product name and model of equipment; name of manufacturer, manufacturer address and phone number; name and phone number of manufacturer's contact; job location (Name of Facility); contract no.; specification number; Contractor name, address and phone number; subcontractor name, address, phone (if applicable); submittal number assigned by Contractor; and submittal date.
 - b. A table of contents listing the headings: instructional objectives; training outline; credentials of Instructor(s); audio/visual requirements; training materials to be used.
 - c. A detailed instructional objective statement on the goal(s) intended to have been achieved by the end of the training session.

- d. The credentials of Instructors are to include name; education; knowledge of equipment; experience of trainer; and employment history with manufacturer.
- e. The audio/visual requirements listing specific equipment that is to be provided by the Contractor for training purposes.
- f. A list of all training materials to be used. An initial Operations and Maintenance (O&M) Instruction Manual, which has received an acceptable disposition, for the equipment shall be required to be utilized by the Instructor in the training and therefore shall be included on this list.
- g. A request of schedule dates and times for each training session.
- h. A training outline indicating the category of training (maintenance and operation, electrical and instrumentation or system); description of the session; length, and type (classroom or field). The training shall include as a minimum:

1) Electrical and Instrumentation Training: System Equipment) Overview:

- a) Describe system (equipment) fundamental operating principals and dynamics.
- b) Identify system's (equipment's) mechanical, electrical and electronic components and features. Review system (equipment) wiring diagrams and process and instrumentation diagrams.
- c) Identify support systems (equipment) associated with the operation (e.g., air intake filters, valve actuators, motors).
- d) Identify and describe safety precautions and potential hazards related to maintenance.
- e) Identify and describe in detail safety and control interlocks.
- f) Identify and describe alarm conditions and response to alarms.
- g) Cover the supply of power to process equipment and related appurtenances, lighting, etc.
- h) Cover low voltage controls, monitoring devices, etc.

2) Electrical and Instrumentation Training Equipment Preventive Maintenance (PM):

- a) Describe PM inspection procedures required to perform an inspection of the equipment in operation, spot potential trouble symptoms and anticipate breakdowns and forecast maintenance requirements (predictive maintenance).
- b) Define the recommended PM intervals for each component.
- c) Provide lubricant and replacement part recommendations and limitations.
- d) Describe appropriate cleaning practices and recommend intervals.
- e) Identify and describe the use of special tools required for maintenance of the equipment.
- f) Describe component removal and installation, and disassembly and assembly procedures.

- g) Perform at least 2 "field" demonstrations of preventive maintenance procedures.
 - h) Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
 - i) Define recommended torque settings, mounting, calibration and alignment procedures and settings, as appropriate.
 - j) Describe recommended procedures to check or test equipment following a corrective repair.
- 3) Electrical and Instrumentation Training Equipment Troubleshooting:
- a) Define recommended systematic troubleshooting procedures.
 - b) Provide component specific troubleshooting checklists.
 - c) Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
- 4) Maintenance and Operation Training: System (Equipment) Overview:
- a) Describe system (equipment) operating (process) function and performance objectives.
 - b) Describe system (equipment) fundamental operating principals and dynamics.
 - c) Identify system's (equipment's) mechanical, electrical and electronic components and features.
 - d) Identify support systems (equipment) associated with the operation (e.g., air intake filters, valve actuators, motors).
 - e) Identify and describe safety precautions and potential hazards related to operation.
 - f) For systems (equipment) comprised of several components: Identify and describe in detail each component's function. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.
 - g) Identify and describe in detail safety and control interlocks.
- 5) Operation and Maintenance Training, Operation of Equipment:
- a) Describe operating principles and practices.
 - b) Describe routine operating, start-up and shutdown procedures.
 - c) Describe abnormal or emergency start- up, operating, and shutdown procedures that may apply.
 - d) Describe alarm conditions and responses to alarms.
 - e) Describe routine monitoring and record keeping procedures.
 - f) Describe recommended housekeeping procedures.
- 6) Operation and Maintenance Training, Troubleshooting:
- a) Describe how to determine if either corrective maintenance or an operating parameter adjustment is required.

4. Once the Lesson Plan submittal has received an acceptable disposition but at least 3 weeks prior to the actual commencement of the training, Contractor shall submit the detailed training material as a Power Point presentation in an electronic format (either DVD, CDR, or flash drive/micro storage) with appropriate labeling. In addition to the electronic format the Power Point material shall be provided in hardcopy for Owner review and approval. The number of copies shall be as defined in Section 01061, Shop Drawings and Submittals. The text and lettering on the presentation slides shall not be smaller than 12 font size and shall be black in color. Slides shall have an appropriate light colored background, resulting in a high contrast between the text and background.
5. Sample Evaluation Form: Submit with Lesson Plan a sample Evaluation Form. Form shall include area for comments and evaluation of Instructor, classroom training and field instruction. Form shall identify Contract name and number, Specification Section, Job location, date and time of training, title of training session, name of manufacturer, model number of equipment, Instructor name, and Contractor and Subcontractor's name.

PART 2 – PRODUCTS

2.1 QUALIFICATIONS OF INSTRUCTOR

- A. The course Instructor shall be knowledgeable and experienced in the details of operation and maintenance of the equipment.
- B. The Instructor must be knowledgeable of the equipment's application specific to this work.
- C. The Owner will reject Instructors who are deemed not in compliance with the above stated minimum qualifications. The Contractor will submit for approval alternate Instructors for consideration. No additional cost will be allowed for replacement of Instructors who are unacceptable to the Owner.

PART 3 – EXECUTION

3.1 EXAMINATION AND VERIFICATION OF CONDITION

- A. The training site for the classroom instruction will be provided by the Owner. The Owner will provide this location.
- B. The Contractor shall coordinate and verify to ensure that, prior to the scheduled training time(s):
 1. The equipment is ready for Operational Demonstration in accordance with Section 017923, Operational Demonstration.

2. That all associated construction required to operate the equipment in all normal and anticipated operating modes is complete.
3. That the equipment area is well lit and unobstructed, so that all training class attendees may access, hear, and view the training.
4. That the equipment area is free of construction activities that could present a hazard to training class participants.
5. That adequate training materials, as required by paragraph 1.5 of this Section, are on hand for use during the training session.
6. Any representatives of interfacing Contractors or equipment suppliers needed to perform supporting operations allowing demonstration of equipment operation have been notified and will be available.

3.2 PREPARATION

- A. Training classes shall be approved by the state-regulating agency for continuing education. This is in the event of the facility choosing to apply for CH/CEU credits for their training program.
- B. Videotaping of all training will be conducted by the Contractor. Before the start of training the Contractor, and the Contractor will review the training site(s) to establish acceptable sight lines, lighting and locations for the participants.
- C. Training classes shall be scheduled through the Owner. Training shall begin within 45 days to the beginning of the Operational Demonstration period. Certain training sessions will occur only during the Operational Demonstration period as specifically noted in the Contract Documents.
- D. Training classes shall be conducted and separated for the following personnel:
 1. Maintenance and Operation
 2. Electrical and Instrumentation
 3. Systems Training
- E. Audio-visual equipment available at the Owner's training sites include:
 1. Blackboards and/ or Whiteboards
- F. Verify training materials are compatible with all equipment. The Contractor is responsible for providing other audio/visual equipment and training aids as needed.
- G. Classroom and field instruction where specified shall be provided for each group. Field instruction will include attention to applied familiarization with the actual equipment. Training hours as required in the Contract Documents do not include travel, set-up or cleanup time by the Instructor.

- H. Training may be either "field" or "classroom" as specified. If not specifically noted, provide field training. For field training, the Instructor will demonstrate all operations of the equipment and may be expected to show assembly and disassembly procedures, maintenance procedures, replacement procedures, and the like. Field training will generally occur at the installed location of the equipment or material unless mock-ups are approved in the Lesson Plan and provided by the Contractor. Such mock-ups will become property of the Owner after the training sessions unless previously requested in the Lesson Plan.
- I. Systems Training:

The Lesson will provide a detailed description of the system design, intended operation, and interactions of systems components. The Contractor's portion of Systems Training will provide additional detail descriptions of system's components and their interface with each other and other systems. Contractor's personnel for system training will be the same personnel who provided Operation and Maintenance training and Electrical and Instrumentation training.
- J. Training shall be conducted to accommodate the Owner's shift schedules. Contractor shall coordinate with Owner prior to scheduling the training sessions. Contractor shall anticipate multiple shifts.

3.3 CONDUCT OF TRAINING

- A. All topics of the approved Lesson Plan shall be discussed, in the classroom or the field, in complete and sufficient detail to allow plant operating personnel to knowledgeably operate and maintain the equipment in accordance with manufacturer's recommended procedures and safety considerations during all anticipated operational and maintenance situations.
- B. Safety concerns and features intended to enhance safety should be specifically addressed.
- C. Tasks required to maintain the warranty should be specifically addressed.
- D. Frequent reference shall be made to the Operation and Maintenance instructions.
- E. Address all questions and comments proposed by the training session participants as they are raised to the maximum extent practicable. If questions or comments cannot be addressed during the training session, additional materials and/or training may be required as determined by the Contractor.
- F. If any training session exceeds three (3) hours in duration, provide a 1/2- hour break.
- G. Ensure that all parts of the training session are legible or audible on the final tape. The Instructor must repeat all questions to insure that they are audible. Final acceptance of the training is contingent on the acceptability of the videotape.

- H. The Contractor will be backcharged for cancelled training classes if the Owner is not notified at least 72 hours prior to scheduled training.
- I. Training Sessions shall be attended not only by the Owner's Operating Personnel but also by members of the Contractor or any other entities designated by the Owner.

3.4 EVALUATION

- A. Immediately following training, the Instructor shall pass out an evaluation form to the Owner's personnel. This form shall provide a means for the Owner's personnel to comment on the Instructor and the quality, completeness, and value of the session.
- B. Evaluation Forms shall be collected, along with the Attendance Sheet at the end of each training session and the original documents shall be submitted to the Owner for use in determining if additional training is required by the Contractor. If additional training is required due to the material as outlined in the Lesson Plan not being covered correctly or in its entirety or the inability of the Instructor to answer questions pertaining to the operation and maintenance of the equipment, or if the training aids or equipment fail to operate as intended, the Contractor shall provide such additional training at no additional cost to the Owner.

END OF SECTION 017933

SECTION 018000 - SYSTEM PERFORMANCES

PART 1 - GENERAL

1.1 GENERAL

- A. It is the intent of this Contract that the final installation shall be complete in all respects.
- B. The Contractor shall be responsible for all minor details, whether or not shown on the Drawings or specifically included in these Specifications.

1.2 BUILDINGS

- A. The building and components shall function properly and in accordance with the plans, specifications and industry standards.
- B. The following components are included, but not necessarily limited to, the following:
 - 1. Roofing
 - 2. Doors
 - 3. Windows
 - 4. Painting Systems
 - 5. Floor Coverings
 - 6. Equipment
 - a. Architectural
 - b. Mechanical
 - c. Electrical

1.3 FACILITIES

- A. The facilities and equipment shall function properly and in accordance with plans, specifications and industry standards.
- B. The equipment includes, but is not necessarily limited to, the following:
 - 1. Valves

2. Pumping Equipment
3. Rotating Equipment
4. Aeration Equipment
5. Chem Feed Equipment
6. Controls
7. HVAC
8. Electrical

1.4 CERTIFICATION

- A. The Contractor shall provide written certification from the manufacturers and/or installers that the various major components are in working order or have been installed in accordance with the manufacturer's instructions.

END OF SECTION 018000

SECTION 024100 - DEMOLITION

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 WORK

- A. It is the intent of this section that the Contractor shall furnish all of the equipment, labor, and materials necessary to demolish various concrete structures and to remove, disconnect and dispose of demolished material and equipment from the site; together with all associated appurtenances as noted on the Contract Drawings, listed in the specifications herein, or as directed by the Engineer.

1.3 JOB CONDITION

- A. The Contractor shall exercise all necessary precaution to protect adjacent properties and roadways from falling debris, material, and sections during the demolition process. All necessary barricades to protect pedestrians and vehicular traffic shall be installed.

1.4 SUBMITTALS

- A. The Contractor shall submit to the Engineer prior to the start of any proposed demolition, a written description of the method proposed to abandon, dismantle, or remove any of the structures or equipment located at the site. Under no circumstances will blasting or the use of explosives be allowed. All wastewater within the system to be improved will be removed before demolition by the Contractor

1.5 SCHEDULE

- A. Pre-demolition Conference: Conduct conference at Project site to comply with pre-installation conference requirements of Division 1.
- B. Arrange demolition schedule so as not to interfere with Owner's on-site operations.
- C. Provide schedule of demolition activities indicating the following:
 - 1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.

2. Dates for shutoff, capping, and continuation of utility services.

- D. Demolition shall be scheduled and performed in strict conformance with these specifications and in a manner which will insure no interruption of WWTP operations beyond that provided for and approved by the Owner. Before any demolition work begins, the Contractor shall obtain approval of all necessary outage requests 72 hours prior to commencement of work from the Owner.
- E. The date and the time of commencing the separate items of demolition work shall be submitted to the Engineer for review, and no demolition work shall commence until the Engineer's approval of date and time for the specific operation is in the hands of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXCAVATION, DEMOLITION & REMOVAL

- A. Locate, identify, disconnect, and seal or cap off indicated utility services serving structures to be demolished.
- B. The Contractor shall disconnect and remove cable from the electrical panel to all equipment.
- C. The Contractor shall be responsible for the excavation, site and equipment demolition as shown on the Contract Drawings, and transportation of all debris, demolished equipment and excavated material surplus to the satisfaction of the Engineer.
- D. The Owner will provide on-site place for excess dirt permanent disposal.
- E. All concrete debris shall be broken down to manageable pieces for on-site disposal per the Owner directions.

3.2 DEMOLITION

- A. Concrete Structures and Building Demolition
 - 1. Remove structures to the lines and grades shown on the Drawings. Where no limits are shown, the limits shall be 4 inches outside the item to be installed.

2. All concrete equipment pads, bases, pipe supports, and similar items are to be completely removed whenever the associated equipment or piping is to be removed, unless specifically designated to remain.
 - a. Remaining floor surfaces shall be repaired so as to leave a neat patch matching the existing floor's appearance, slope, and floor finish.
 - b. Concrete for patching shall comply with Division 3, Cast-In-Place Concrete.
3. Structural concrete, if shown to be removed or partially removed, shall be neatly removed and patched.
4. Removal of structural concrete will require temporary support of the adjacent concrete until such time as the new structure of concrete has cured sufficiently to allow the removal of formwork, shoring, and bracing.
5. As soon as removal work has otherwise been completed and approved by the Engineer, required filling shall be performed in accordance with Division 31, Excavating, Backfilling and Compacting. The final grade of required backfill in areas outside the prism of construction shall be such as to present a neat appearance. It shall be well drained and shall prevent water from draining unnecessarily onto adjacent areas.

B. Pavement, Sidewalks, Curbs, Etc.:

1. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat and free from chipped or damaged edges.
2. For removal of reinforced or non-reinforced concrete, the minimum depth of saw cut shall be 3 in.
3. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel. The minimum depth of saw cut shall be 3 in.
4. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.
5. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purpose of this Contract.
6. Pavement shall be excavated to neat lines and, only to widths required for trenches, for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation.

7. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

C. Catch Basins, Inlets and Similar Structures

1. Existing drainage structure designated by the Engineer to be removed shall be completely removed.
2. Abandoned sewers shall be sealed and made watertight with approved masonry bulkheads.

D. Railings

1. Wherever the Drawings indicate that a portion of an existing length of railing is to be removed, the Contractor shall remove this railing, plus all existing horizontal rails between this area and the first post beyond this area (on each side of the area). Neatly saw cut all removed rails at the post which is to remain and cap ends unless otherwise shown.

E. Mechanical

1. General:

- a. Mechanical removal consists of dismantling and removing existing piping, including residual contents, sediments, or grit, pumps, motors, equipment, supports, and other appurtenances as specified, shown, or required for the completion of the Work.
- b. In general, the notation to remove a particular equipment item shall be interpreted to include the removal of all associated piping, bases, supports, anchors, controls, conduit, wiring and related appurtenances unless specifically designated or ordered to the contrary.
- c. Contractor shall be responsible for identification, removal and disposal of all piping and equipment that contains lead-base paint. All applicable State and Federal Regulations shall be enforced during removal of these items.

2. Piping

- a. Piping removal includes cutting, capping, and plugging as required.

- b. Remove existing process, water, chemical, gas, fuel oil, and other piping not required for the new Work or existing installations where indicated or where it will interfere with the new Work.
- c. Plant Service Lines (plant air, flushing water, city water, etc.), waste lines, vents, and drain lines are to be removed or relocated as indicated. Temporary connections of these lines to other portions of the wastewater plant are to be provided and maintained by the Contractor until such time as the lines can be permanently installed in their new locations.
 - 1) Any temporary shut-down of these lines for relocation, modification or temporary installation shall in no case exceed 4-hours duration unless otherwise noted or accepted by Owner.
 - 2) Any line remaining in service shall, at all times, be protected from clogging or other damage during construction and from freezing throughout the duration of this Contract.
- d. Purge volatile gases and make safe all process lines, fuel lines, and tanks prior to removal or capping.
- e. Piping to be removed shall be removed to the nearest solid support.
- f. Cut off and properly cap both ends of remaining piping which passes through and is embedded in existing walls.
- g. Properly cap the remaining piping left open by demolition work.
- h. When piping is to be altered, install temporary plugs or caps in the remaining pipe until such time as the piping modifications are made.
- i. Waste, Vent, and Drain Lines: Plug upstream ends of remaining pipe with cleanouts and plugs.
- j. Remove vent stacks, where shown, which pass through existing roofs. Properly patch and seal watertight penetration through the roof that is left by removal of the stack. All necessary precaution shall be taken to ensure that any existing roofing warranties shall not be rendered void by the subject work.
- k. Potable Water Piping
 - 1) Conform with all applicable codes and requirements when making changes to potable water piping.
 - 2) Pressure test and disinfect in Division 2, Waterline Construction, and any local codes all portions of the potable water system that have been altered or opened.

3.3 REPAIR/RESTORATION

A. The Contractor shall be responsible for providing all such minor repairs, patches and cover plates, whether specifically shown or described or not.

B. Concrete

1. Repair all surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein or in other Sections of these Specifications, or shown on the Drawings, and which will remain as architecturally finished surfaces and which have holes, scars, chipped or other damaged surfaces revealed by the removal.
2. Use the same or matching materials as the existing surface or as may be otherwise directed by the Engineer.
3. Where the use of matching materials is not available or where their use is not feasible or practical, or where so indicated or directed by the Engineer, stainless steel cover plates may be used to conceal scarred surfaces or openings. Cover plates shall be brushed satin finish, gasketed, and attached to the existing surface with counter sunk stainless steel screws.

C. Exposed Surfaces

1. Repair all surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein or in other Sections of these Specifications, or shown on the Drawings, and which will remain as architecturally finished surfaces and which have holes, scars, chipped or other damaged surfaces revealed by the removal.
2. Use the same or matching materials as the existing surface or as may be otherwise directed by the Engineer.
3. Where the use of matching materials is not available or where their use is not feasible or practical, or where so indicated or directed by the Engineer, stainless steel cover plates may be used to conceal scarred surfaces or openings. Cover plates shall be brushed satin finish, gasketed, and attached to the existing surface with counter sunk stainless steel screws.

D. Junction Points

1. After removal of part or all of concrete or masonry walls, slabs and like work which tie into new Work or existing work. Neatly repair the point of junction so as to leave only finished edges and surfaces exposed.

E. Painting

1. All surfaces exposed by the removal operations required by this Contract; all plugs, seals, closures pieces, cover plates, and similar equipment; and all surfaces disturbed by the removal operations that shall remain visible or become a part of an exposed architectural surface shall be thoroughly cleaned, primed and finish painted in accordance with Division 9, Painting.

3.4 CLEANING

- A. Upon completion of the Work, remove all materials, equipment, waste, and debris of every sort and leave the premises clean, neat, and orderly.
- B. Pollution Controls
 1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.
 - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations.
 - c. Do not rinse into plant drains or storm sewers without obtaining prior acceptance from the Owner.
 - d. Comply with governing regulations pertaining to environmental protection.
 2. Disposal of Materials
 - a. Remove from the site and properly dispose of all debris resulting from the demolition operations as it accumulates.
 - b. Dispose of debris which is not to remain the property of the Owner in conformance with all existing applicable laws and regulations.
 - c. Obtain permit or written permission of the property owner or governing entity on whose property the materials and debris are placed.

3.5 BACKFILLING

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Division 31.

END OF SECTION 024100

SECTION 024119 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

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 WORK

- A. This section includes removal of pavement, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. State and local code requirements shall control the disposal of debris resulting from the removal operation.

1.4 PROTECTION

- A. Structures shall be removed in such a manner as not to damage portions of the existing structure which are to remain in place.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PAVEMENTS, SIDEWALKS, CURBING, SIMILAR STRUCTURES

- A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat and free from chipped or damaged edges.

- B. For removal of reinforced or non-reinforced concrete, the minimum depth of saw cut shall be 3 in.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.
- D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

3.2 EXCAVATION OF RIGID PAVEMENT

- A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purpose of this Contract.
- B. Pavement shall be excavated to neat lines and, only to widths required for trenches, for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation.
- C. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

3.3 CATCH BASINS, INLETS AND SIMILAR STRUCTURES

- A. Existing drainage structure designated by the Engineer to be removed shall be completely removed.
- B. Abandoned sewers shall be sealed and made watertight with approved masonry bulkheads.
- C. All castings salvaged from abandoned or removed drainage structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a site designated by the Engineer or incorporated in the work where called for on the Drawings, scheduled, or so directed.

3.4 FENCE

- A. Where so required by the Drawings, existing fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.

- B. Wood posts and other materials not considered salvageable by the Engineer shall be disposed of by the Contractor.
- C. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

3.5 EQUIPMENT REMOVAL

- A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall remain the property of the Owner and shall be stored at site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.

3.6 DISPOSAL OF DEBRIS

- A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be disposed of offsite.
- B. The Contractor shall police the hauling of debris to insure that all spillage from haul trucks is promptly and completely removed.

3.7 BACKFILLING

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Section 310000 - Earthwork.

END OF SECTION 024119

SECTION 026500 - UNDERGROUND STORAGE TANKS REMOVAL / ABANDONMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Bid Documents, General and Supplementary Conditions and other Contract Documents apply to work of this section.

1.2 SUMMARY

- A. This section includes provisions for the following items:
 - 1. Preparation to Underground Storage Tanks (USTs) Prior to Removal
 - 2. Purging of USTs to Remove Flammable Vapors
 - 3. Testing of USTs for Flammable Vapors and Oxygen Concentration
 - 4. Removal of the USTs from the Excavation Site
 - 5. Proper Abandonment and Disposal of the USTs
- B. It is the intent of this contract that the final removal be complete in all aspects and the Contractor shall be responsible for minor details and any necessary special construction/excavation not specifically included in these specifications.

1.3 DESCRIPTION OF WORK

- A. The Contractor shall furnish all labor, materials and appurtenances necessary to perform the tasks outlined in these specifications. The Contractor is also responsible for arranging for a certified inspector to be on-site. This section provides provisions for the following items:
 - 1. Preparation of the USTs prior to removal consists of the following:
 - a. Observing the special precautions in regards to worker exposure to petroleum hydrocarbon liquids, vapors, or wastes; toxicity considerations of petroleum substances including, but not limited to, benzene and tetraethyl lead (if applicable).
 - b. Drainage of product piping into the USTs, careful to avoid spillage, and capping/removing of product piping.
 - c. Removal of residues and liquids from the USTs.
 - d. Excavation of site directly above the top of the USTs.
 - e. Removal of the fill pipe, gauge pipe, vapor recovery truck connection, submersible pumps, and other tank fixtures.
 - f. Capping of all non-product lines, except the vent, and plugging all other tank openings.

2. Purging of the USTs of all flammable vapors consists of the following:

CAUTION! Purging of the USTs provides a “temporary” vapor-freeing of the tank atmosphere. However, it should be noted that this process is indeed “temporary” and that a combustible gas indicator (CGI) shall be present and in operation at all times during the UST’s removal.

CAUTION! The work area shall be free from sources of ignition such as smoking materials and non-explosion-proof electrical and internal combustion equipment. Prevent the discharge of static electricity and the accumulation of flammable vapors at ground level.

CAUTION! Certain methods of purging the USTs, if chosen, not only displace the flammable vapors inside of the USTs, but also devoid them of oxygen.

- a. Vent all vapors from the tank at a minimum of twelve (12) feet above grade and three (3) feet above any adjacent roof lines.
 - b. USTs may be vented by any of the following means so long as they meet local and state regulations: purging with an inert gas such as Nitrogen (N₂) or Carbon Dioxide (CO₂) through the tank fill opposite the tank vent under low pressure to avoid the generation of static electricity and not exceeding five (5) pounds per square inch (psi), solid CO₂ (dry ice) at 1.5 pounds per 100 gallons of tank capacity may be added to the tank to displace flammable vapors, or tank vapors may be exhausted by either the use of an educator-type air mover or a diffused air blower.
3. Testing of USTs for Flammable Vapors and Oxygen Concentration consist of the following:
- a. The tank atmosphere and points surrounding the excavation area shall be regularly tested for flammable or combustible vapor concentrations until the USTs are removed from both the excavation and the site. The excavation site shall be regularly tested to ensure safe oxygen levels.
 - b. Readings of 10 percent or less of the lower flammable limit must be obtained before the UST is considered safe for removal from the ground.
4. Removal of the USTs from the Excavation Site consists of the following:
- a. After it has been determined that the USTs have been freed of flammable vapors, excavation around the tanks may proceed.
 - b. Remove the USTs from the excavation and place them on a level surface, placing blocks of wood to prevent movement of the tank.
 - c. Open the USTs and clean internally. Place all bottom sludge into properly labeled 55-gallon drums.
 - d. Load the USTs on a truck trailer and secure them for transportation properly so that the tank vents are at the uppermost point on the USTs.
 - e. The USTs shall be transported in accordance with all applicable local, state, and federal regulations.
5. Proper Abandonment and Disposal of UST’s

- a. Removal of residues and liquids from the USTs.
 - b. Removal of the fill pipe, gauge pipe, vapor recovery truck connection, submersible pumps, and other tank fixtures.
 - c. Capping of all non-product lines, except the vent, and plugging all other tank openings.
 - d. Drill a core hole opening at the bottom of the USTs to allow for drainage.
 - e. Fill the USTs with No. 57 stone, cap and backfill USTs
- B. Related Specifications: The following specifications contain requirements that relate to this section.
 - 1. Abandoned Treatment Units. Septic tanks that are no longer in use shall be completely pumped. The bottom of the tanks shall be cracked so the tank will not water, and the tank shall be filled with sand or soil. If the tank is removed from the ground, the excavation shall be filled with soil.

1.4 QUALITY ASSURANCE

- A. In addition to the requirements of these specifications, comply and obtain any necessary permits within the regulations of the Ohio State Fire Marshal's Bureau of Underground Storage Tank Regulations (BUSTR), the Occupational Safety and Health Administration (OSHA), the Ohio Environmental Protection Agency (OEPA), and the Willoughby Fire Department regarding the proper removal procedures.

1.5 SUBMITTALS

- A. Contractor Qualifications: The Contractor shall submit documentation of current Ohio UST removal certification.
- B. Previous Experience: The Contractor shall provide documentation of at least five (5) completed projects of comparable scope and complexity which are acceptable to the Owner's Agent.
- C. Product Data: The following product data must be submitted for approval prior to the Preparation of the USTs prior to removal as indicated in section 1.3 (A) (1) of these specifications.
 - 1. Calibration records or certification of the Contractor's CGI and/or Oxygen Concentration detector(s).

1.6 JOB CONDITIONS

- A. Utilities: Determine the location of all underground utilities at least 72 hours prior to excavation. Submit requests to have above ground utility cables protected or relocated at least seven (7) days prior to the start of work.

- B. Work Area: All work activities shall be limited to the areas specified on the site plans in order to minimize interference with normal operations on the premises.
- C. Site Access: Contractor shall provide access to the site Owner and Owner's Agent for inspection of all construction/excavation activities.

1.7 CONTRACTOR'S/ENGINEER'S USE OF THE PREMISES

- A. General Conditions: In general, during the entire period of the scope of work, the Contractor shall have exclusive use of the premises for construction/excavation activities. Special conditions related to the Contractor's use of the premises are listed below:
 - 1. Keep all excavation, stockpiling, backfilling and site restoration activities confined to the allowable work area specified on the site plans provided.
 - 2. Keep existing driveways and entrances serving the premises clear and available to the Owner, his/her employees and representatives at all times, as well as for the Contractor's access. Do not use these areas for parking or storage of materials.
 - 3. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials to a specific site. No storage sheds are to be constructed or installed for temporary use in any location of the project area during project implementation.
 - 4. Lock automotive type vehicles, automobiles, trucks and other mechanized or motorized equipment, when parked or unattended, to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place or accessible to unauthorized persons.
 - 5. Smoking or open fires are not permitted within 100 feet of the excavation or stockpile areas.
 - 6. The Contractor shall provide adequate barriers or barricades to restrict objects, equipment or personnel from entering any excavation on-site. These barriers or barricades should consist of high-visibility materials and shall be erected during all periods of inactivity.

1.8 PROJECT COORDINATION

- A. Administrative Requirements: This section specifies administrative and supervisory requirements necessary for project coordination. In general, the Contractor shall assign a Project Coordinator to serve as a liaison between the Contractor and the Owner's Agent. In addition, the Contractor shall coordinate progress meetings and keep daily logs of those meetings and any accidents which may occur.
- B. Accident Reports: The Contractor shall prepare and submit reports of significant accidents occurring at the site or anywhere else while work is in progress. These reports should record and document data and actions and comply with OSHA and industry standards. For the purposes of this section, a significant accident is defined to include events where personal injury is sustained which requires more than first aid (as defined by OSHA) or involves more than one-half day of lost time from

work, or where property damage in excess of \$100.00 is sustained, or where the event posed a significant threat of personal injury or property damaged.

1.9 AUTHORITY TO STOP WORK

- A. The Owner's Agent, should the Owner determine hazardous or dangerous conditions exist, has the authority to stop the Contractor's work at any time it is determined that conditions are not within the required specifications and/or governmental regulations. Work shall not continue until conditions have been corrected and steps have been taken to the satisfaction of the Owner's Agent and a written notice has been given to the Contractor to start work again. Standby time required to resolve any specification-related items or regulatory agency violations shall be at the Contractor's expense.

PART 2 – PROJECT DESCRIPTION

2.1 MATERIALS AND EXCAVATION

- A. Spill Prevention Equipment:
 - 1. Spill prevention equipment shall prevent a release of product to the environment when removing the fill pipe, gauge pipe, vapor recovery truck connection, submersible pumps, and other tank fixtures.
 - 2. Spill prevention equipment shall prevent a release of product to the environment when removing the USTs from the excavation site.
 - 3. Spill prevention materials shall consist of drip pans beneath any disconnection of piping, absorbent material specifically for oil and other petroleum products, shovels and at least one (1) 55-gallon polydrum for any contaminated soil as a direct result of a release due to excavation.
 - a. If a contamination is evident at the excavation site that is not a direct result of a release due to excavation, refer to section 1.3 (A) (4) (d) of these specifications.
- B. Excavation Equipment:
 - 1. All necessary equipment for the entire scope of work described shall be supplied by the Contractor as previously stated in section 1.3 (A) of these specifications.

PART 3 – EXECUTION

3.1 ORDER OF WORK

- A. In coordination with tank removal on the premises, the excavation of the USTs will include the following tasks:

1. Conducting preliminary site visits, contracting utility companies, and attending a pre-construction meeting.
2. Taking the USTs and systems in conjunction with the USTs off-line, preparation of the USTs for removal, purging and testing of tank atmospheres of flammable vapors, removal of the USTs from the excavation site, and proper storage and disposal of the USTs (if applicable).
3. Site survey of the excavation site for signs of contamination.

3.2 SITE RESTORATION

- A. Any disturbed areas surrounding the site shall be restored, as closely as possible, to the same or better condition existing prior to the start of work and shall include the following:
 1. Replacement of excavation fill and the addition of clean fill to return the site to the level of the surrounding grade, sodding, seeding, mulching, etc.
 2. All disturbed concrete slabs or aprons shall be replaced in accordance with the Owner's Agent or the Owner.

END OF SECTION 026500

SECTION 030000 - CONCRETE 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 section.
 - 1. Section 013319 – Field Testing Requirements
 - 2. Section 400523 - Process Valves

1.2 SUMMARY

- A. Provide all materials and labor necessary to complete all concrete, plain and reinforced, as indicated on Drawings or as specified in these specifications and as required to complete the Project. Work, without limiting the generality thereof, includes:
 - 1. Installation of concrete to provide mechanical equipment support, and other incidental concrete Work.
 - 2. Furnishing and installation of admixtures.
 - 3. Work of other trades required to be built into concrete, such as inserts for connections to steel members, anchors, embedded plates, concrete adhesive anchors, and reinforcing dowels.
 - 4. Finishing of concrete as specified herein or as indicated on Drawings.
- B. This Section specifies cast-in place concrete, including form work, reinforcing, mix design, placement procedures and finishes.

1.3 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements and 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Submit data for proprietary materials and items, including but not limited to, repair mortar, concrete mix design data, Portland cement, fly ash, reinforcement, forms, forming accessories, bonding agent, admixtures, patching compounds, anchor adhesive, curing compounds, and others as requested by Engineer.
 - 1. Mix Design: Submit each proposed concrete mix design. Mix design(s) proposed shall be sealed by a Professional Engineer registered in the state of Ohio. The concrete mix design shall provide the following data:
 - a. The expected strength.
 - b. Corresponding slump before and after the introduction of mid- or high-range water-reducing admixtures.
 - c. Weights and test results of the ingredients.
 - d. Concrete mix compressive strength test results.
 - e. Other physical properties necessary to review each mix design for conformance with these specifications.

- f. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - g. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
 2. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
 3. Thermal Control Plan: Signed and sealed by a licensed Professional Engineer
- C. Shop Drawings; Reinforcement: Submit original shop drawings prepared for fabrication, bending, and placement of concrete reinforcement. Comply with ACI Detailing Manual showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Shop Drawings; Construction joint location: Submit schematical shop drawings for each structure that shows construction joints, pour sequences, waterstop locations, and waterstop information
- E. Shop Drawings; Form work: Submit shop drawings prepared by a registered Professional Engineer for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually.
1. Submit manufacturer's data on the form snap-tie assembly including rubber type form-tie waterstop for environmental and/or below grade structures.
 2. Submit the hydrostatic pressure that the forms are capable of resisting with standard safety factors. Identify the placement rate of concrete per the forms design and the size of the structure.
 3. Engineer's review is for general architectural applications and features only. Design of form work for structural stability and efficiency is Contractor's responsibility.
- F. Samples: Submit samples of materials and products as requested by Engineer, including names, manufactures, sources, and descriptions, including but not limited to the following.
1. Coarse aggregate source and testing data
 2. Fine aggregate source and testing data
 3. Pozzolan source and testing data
 4. Portland cement source and testing data
 5. Reinforcing manufacturer and testing data
 6. Form release agent and manufacturer
 7. Adhesive anchor manufacturers
- G. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design tests.
1. The proposed mix design submittal(s) shall follow the procedures of Chapter 5, Sections 5.2 to 5.3 of ACI-318.
 2. Reference should be made to ACI-211.5R "Guide for Submittal of Concrete Proportions" for the required submittal information. Sample forms for presenting the necessary information can be found in the addendum at the end of this section. Example Form B should follow a completed Example A in the submittal when laboratory trial batches are used to document a water-cementitious materials ratio curve.

3. Additional data summarizing the past performance records should be an integral part of the submittal if the submittal is based on past performance with the proposed materials and proportions.
- H. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Engineer. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, latest revisions, except where more stringent requirements are shown or specified:
1. ACI 301 "Specifications for Structural Concrete for Buildings."
 2. ACI 318 "Building Code Requirements for Reinforced Concrete."
 3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
 4. ACI 347 "Guide to Form work for Concrete."
 5. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 6. ACI 232.3R - Report on High-Volume Fly Ash Concrete for Structural Applications.
 7. ACI 305R - Guide to Hot Weather Concreting.
 8. ACI 305.1 (305.1M) - Specification for Hot Weather Concreting.
 9. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 10. ACI 306R - Guide to Cold Weather Concreting.
 11. ACI 308.1 (308.1M) - Specification for Curing Concrete.
 12. ACI 350.5 (350.5M) - Specifications for Environmental Concrete Structures.
 13. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 14. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
 15. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 16. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 17. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
 18. ASTM C150/C150M - Standard Specification for Portland Cement.
 19. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 20. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
 21. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 22. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 23. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
 24. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- B. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.
- C. Engage a testing agency acceptable to Engineer to perform initial material evaluation and certification tests for mix designs and to design concrete mixes.

- D. Pre-installation Conference: Conduct conference at project site to comply with requirements of Division 1 Section "Project Meetings" and the following:
1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials, inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
 - a. Contractor's Superintendent
 - b. Agency responsible for concrete design mixes.
 - c. Agency responsible for field quality control.
 - d. Ready-mix concrete producer.
 - e. Concrete Subcontractor
 - f. Primary admixture manufactures.
- E. Concrete Testing Service: Employ and pay an independent testing laboratory, acceptable to the Owner and Architect to perform material evaluation tests and to review concrete mix designs proposed by Contractor to conform to this Specification.
- F. Alkali-Silica Reactivity Testing: Aggregates used in the concrete shall be tested by an independent testing agency for alkali-silica reactivity in accordance with ASTM C1260.

1.5 PROJECT CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301, ACI 306.1, and as follows:
1. Protect concrete Work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures.
 2. When average high and low temperature is expected to fall below 40 deg. F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete in contact with surfaces less than 35 deg. F, other than reinforcing steel.
 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature at time of discharge not to exceed 95 deg. F.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- C. Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two (2) edges and one side for tight fit.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Engineer's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- D. Forms for Cylindrical Columns and Supports: Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
- E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- F. Form Ties: Factory-fabricated, adjustable-length, snapoff metal or glass fiber-reinforced plastic form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to the exposed surface.
 - 1. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.
 - 2. All form ties shall have a factor of safety of two (2) to determine the recommended safe working load.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf) hot-dip galvanized, after fabrication and bending.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 775.
 - 1. Repair of damaged epoxy-coating - When required, damaged epoxy-coating shall be repaired with patching material conforming to ASTM A 775. Repair shall be done in accordance with the patching material manufacturer's recommendations.
- D. Steel Wire: ASTM A 82, plain, cold-drawn steel.

- E. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. (Flat sheets only)
- F. Welded Deformed Steel Wire Fabric: ASTM A 497.
- G. Epoxy - Coated Welded Wire Fabric: ASTM A884, Class A.
- H. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.1 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II, I/II, V low alkali, and ASTM C 595 blended cement Type IP for typical structures and Type MS for environmental structures.
 - 1. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.
 - a. Different types of cement shall not be mixed or used alternately without specific written approval by the Engineer.
 - b. Different brands of cement may be used when authorized in writing by the Engineer. A resubmittal will be required if different brands are proposed during the Project.
 - 2. Portland cement shall contain less than 0.60 percent alkalis. Portland-pozzolan cement shall be low alkali.
- B. Concrete mixtures shall include either fly ash or slag as shown below, but within the limits stipulated in 2.4.C, unless the proposed combination of cementitious materials has been tested in accordance with ASTM C 1012 and resulted in expansion of not more than 0.10 percent at 6 months.
 - 1. Fly Ash, conforming to ASTM C618, Class F. Limit use of fly ash to not exceed 30% of cementitious material by weight.
 - a. Fly ash pozzolan shall contain less than 1 percent by weight of carbon and less than 3 percent by weight of sulfur trioxide.
 - b. Alkali content (%Na₂Oeq) less than 3.0%.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120: Limit use of granulated blast-furnace slag to not exceed 65% of cement content by weight.
 - 3. The pozzolan supplied during the life of the project shall have been formed at the same single source. The pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.
- C. Normal Weight Aggregates: Fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates shall be regarded as separate ingredients.
 - 1. Aggregates shall be non-reactive and shall be washed before use. Provide aggregates from a single source for exposed concrete.

2. Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes to produce a concrete that has optimum workability and consolidation characteristics. The final combined aggregate gradation shall be established during the design mix.
 3. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
 4. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Engineer.
 5. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).
- D. Fine aggregate: fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33.
- E. Coarse aggregate: coarse aggregate shall be hard, angular (not river washed), dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 3. Gradation of each coarse aggregate size shall conform TO ASTM C33, Table 2.
- F. Water: Conform with ASTM C94. Water for washing aggregate, for mixing and for curing shall be potable and free from oil and deleterious amounts of acids, alkalis, and organic materials; shall not contain more than 1,000 mg/l of chlorides as Cl, nor more than 1300 mg/l of sulfates as SO₄; and shall not contain an amount of impurities that may cause a change of more than 25 percent in the setting time of the cement nor a reduction of more than 5 percent in the compressive strength of the concrete at 14 days when compared with the result obtained with distilled water. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.
- G. Admixtures shall be compatible with the concrete and with each other. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the concrete mix.
1. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.
- H. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Air-Mix"; Euclid Chemical Co.
 - b. "Sika Aer"; Sika Corp.
 - c. "MB-VR or MB-AE"; Master Builders.
- I. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. “WRDA”; W.R. Grace.
 - b. “Eucon WR-75”; Euclid Chemical Co.
 - c. “Pozzolith Normal”; Master Builders.
- J. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F and containing not more than 0.1 percent chloride ions.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. “Sikament 300”; Sika Chemical Corp.
 - b. “Eucon 37”; Euclid Chemical Co.
 - c. “Rheobuild or Polyheed”; Master Builders.
- K. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. “Accelguard 80”; Euclid Chemical Co.
 - b. “Pozzutec 20”; Master Builders.
 - c. “Daraset”; W.R. Grace & Co.
- L. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. “Pozzolith”; Master Builders.
 - b. “Eucon Retarder 75”; Euclid Chemical Co.
 - c. “Plastiment”; Sika Chemical Co.
- M. Antimicrobial crystalline waterproofing admixture: Provide Xypex Bio-San C500 admixture as manufactured by Xypex Chemical Corporation. Dosage rate shall be 1.0% by weight of total cementitious material content in the concrete. No substitution of this admixture shall be acceptable. This admixture shall be incorporated in concrete utilize in environmental structures in accordance with manufacturer’s recommendations and requirements. Antimicrobial crystalline waterproofing admixture shall be used in all concrete for structures that are in concrete with sanitary effluent.
- N. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Catexol 1000CL; Axim Concrete Technologies.
 - b. MCI 2000 or MCI 2005; Cortec Corporation.
 - c. DCI or DCI-S; W.R. Grace & Co., Construction Products Div.
 - d. Rheocrete 222+; Master Builders, Inc.
 - e. FerroGard-901; Sika Corporation.

2.2 RELATED MATERIALS

- A. Granular Base: Evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.
- B. Non-Shrink Non-metallic Grout: CRD-C 621 and ASTM C-1107, factory pre-mixed grout.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Non-metallic
 - 1) “Set Grout”; Master Builders.
 - 2) “Euco-NS”; Euclid Chemical Co.
 - 3) “Five Star Grout”; U.S. Grout Corp.
- C. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rust-proof, and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
- D. Colored Wear-Resistant Finish: Packaged, dry, combination of materials, consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with cement. Color as selected by Engineer, unless otherwise indicated.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. “Colorcron”; Master Builders.
 - b. “Surflex”; Euclid Chemical Co.
 - c. “Lithochrome”; L.M. Scofield Co.
- E. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- F. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. Polyethylene-coated burlap.
- G. Liquid Membrane-Forming Curing Compound: Liquid type membrane- forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg./sq. m. when applied at 200 sq ft./gal.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. “Masterkure”; Master Builders.
 - b. “Ecocure”; Euclid Chemical Co.
 - c. “Horn Clear Seal”; A.C. Horn, Inc.

- H. Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound for applications from 1 inch thick to feathered edges.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Flo-Top"; Euclid Chemical Co.
 - b. "Underlayment 110," Master Builders, Inc.
 - c. "Thoro Underlayment Self-Leveling"; Thoro System Products.
- I. Bonding Compound:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Epoxy based:
 - 1) "Sikadur 32 Hi-Mod"; Sika Chemical Corp.
 - 2) "Euco Epoxy 620"; Euclid Chemical Co.
 - 3) "Epoxite Binder 2390 "; A.C. Horn, Inc.
 - 4) "Perma Prime 3C Bonding Agent"; Dayton Superior Corp.
- J. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Epoxite Binder 2390"; A.C. Horn, Inc.
 - b. "Sikadur 32 Hi-Mod"; Sika Chemical Corp.
 - c. "Euco Epoxy 452 or 620"; Euclid Chemical Co.
- K. High Strength Repair/Patching Mortar: Contractor can, either provide a batch/site mix or a premanufactured bag mix. See Table I for a batch/site mix.
1. premanufactured bag mix shall be polymer modified shrinkage compensated, rapid setting, high strength mortar specifically formulated to make structural repairs in vertical and overhead applications.
 2. Bag mix shall conform to ASTM C928 R2 for structural concrete repair and have a 28-day strength of at least 6,000 psi.
 3. Bag mix maybe extended with aggregate if approved by manufacturer.
 4. The following are approved manufacturers::
 - a. Sika Chemical Corp.
 - b. Five Star Products. Inc
 - c. Euclid Chemical Company
 - d. CTS Cement Manufacturing Corp.
 - e. Dayton Superior Corporation
 - f. SpecChem

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 and ACI 211. If the trial batch method is used, use an

independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Engineer.

1. Concrete shall be normal weight concrete composed of specified cement, pozzolan, admixtures, aggregates and water proportioned and mixed to produce a workable, strong, dense, and impermeable concrete.
 2. The Contractor may substitute interground Portland-pozzolan cement conforming to ASTM C595, containing the specified amount of pozzolan in lieu of Portland cement and pozzolan. Pozzolan may be omitted in concrete exposed to normal atmospheric conditions and concrete not in contact with the ground or liquid. Water/cement ratio is based on the combined contents of cement and pozzolan in a given mix proportion.
 3. Controlled Low Strength Material (CLSM) shall be a flowable concrete slurry mix, consisting of cement, pozzolan, water, coarse and fine aggregate. The concrete slurry mix shall be produced by a ready-mix concrete supplier.
- B. Submit written reports to Engineer and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Engineer.
- C. Design mixes to provide normal weight concrete with the following properties, as indicated in Table I:

TABLE 1

CONCRETE REQUIREMENTS

Concrete <u>Class</u>	ASTM Coarse Aggregate Size	Maximum Water/Cement <u>Ratio</u>	Pozzolan, Percent by Weight of Cementitious Materials ^a	Minimum Air Content (<u>Percent</u>)	Minimum ^b 28-Day Compressive <u>Strength, PSI</u>	Slump Range Min-Max /Admix ^c (<u>Inches</u>)
A	57	0.43	20-28	5.5 ^c	5000	3-4/8
B	467 ^d	0.45	20-28	5.5 ^c	3500	4-5/8
C	8	0.48	20-28	5.5	3000	5-6/9
D	57	0.42	20-28	5.5 ^c	5000	3-4/8
G	78 ⁱ	0.45	-	-	3000	7 ^j
M	78 ^j	0.40	5-25	5.5	5500	3-4/5
F	57 ^h	1.33 ^h	10-30 ^h	15 ^h	100 ⁱ	8 ^h

- a Pozzolan content may be included in cementitious fraction. Based on the fly ash ratios, for GGBFS pozzolan shall be multiplied by 1.75.
- b Compressive strength shall be determined at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39.
- c Plus or minus 1.5 percent.
- d ASTM coarse aggregate gradation 57 may be substituted at Contractor's option.
- e Min and max represent slump due to water only. Admix refers to recommended maximum slump for the mix after the incorporation of water reducing admixtures.
- h Contractor to determine.
- i Plus or minus 25 psi.
- J Contractor may submit substitution for approval.

1. Typical cast-in-place structural concrete shall be Class A, except as otherwise specified or shown on the drawings.
 2. Sitework, non-structural concrete (sidewalks, curbs, pavers, etc.) shall be Class B unless otherwise noted on the drawings.
 3. Class C shall be used for grouting manhole inverts, as a topping for sloping slabs, forming manhole benches, etc.
 4. Cast-in-place concrete for environmental structures shall be Class D, except as otherwise specified or shown on the drawings.
 5. Masonry grout, for bond beams, grouting cells and precast planks shall be class G.
 6. High strength repair mortar shall be class M.
 7. Controlled Low Strength Material, if required, shall be Class F.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.
- E. Admixtures:
1. Use high range water-reducing admixture (super plasticizer) in Classes A concrete unless noted otherwise.
 2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
 3. Use air-entraining admixture in all concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content within limits shown in Table I.
 4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
 5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as shown in Table I:
 - a. Concrete containing HRWR admixture (super-plasticizer): Not more than 8" after addition of HRWR to site-verified 2"-3" slump concrete.

2.4 CONCRETE MIXING

- A. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
1. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

- a. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- C. Prepare design mixtures for each type of concrete required.
 - 1. The inclusion of either fly ash or slag in the concrete mix is mandatory.
 - 2. Where fly ash is used:
 - i. The minimum fly ash content shall be 20 percent, and the maximum shall be 30% of cementitious material by weight.
 - ii. Additional fly ash shall not be included in concrete mixed with blended cements.
 - 3. Where slag is used:
 - i. The minimum slag content shall be 50 percent and the maximum shall be 65% of cementitious material by weight.
 - ii. Additional slag shall not be included in concrete mixed with blended cements.

2.5 PRODUCT DATA

A. MANUFACTURER'S DATA:

- 1. Copies of manufacturer's data shall be provided for the following:
 - a. Cement
 - b. As-delivered concrete strength, slump, temperature, and air content
 - c. Final laboratory report.

B. READY-MIXED CONCRETE TRUCK DELIVERY TICKETS:

- 1. Each load of ready-mixed concrete delivered to the job site shall be accompanied by a delivery ticket showing the information listed in ASTM C94, Section 16.
- 2. With each load of concrete delivered to the job there shall be furnished by the ready mixed concrete producer duplicate delivery tickets, one for the Contractor and one for the Engineer. Delivery tickets shall provide the following information:
 - a. Date and serial number of ticket;
 - b. Name of ready mixed concrete plant;
 - c. Job location;
 - d. Contractor;
 - e. Type and brand name of cement;
 - f. Mix number or specified cement content in bags per cubic yard of concrete;
 - g. Truck number;
 - h. Time dispatched stamped by a time clock;
 - i. Amount of concrete in load in cubic yards;
 - j. Admixtures in concrete, if any;
 - k. Maximum size of aggregate;
 - l. Water added at job, if any;
 - m. Slump of concrete ordered

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 FORMS

- A. Design, erect, support, brace, and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain form work construction tolerances complying with ACI 347.
- B. Design form work to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- E. Provide temporary openings where interior area of form work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Provisions for Other Trades: Provide openings in concrete form work to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER INSTALLATION

- A. Following leveling and tamping of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

- B. Lap joints 6" and seal with manufacturer's recommended mastic or pressure-sensitive tape.

3.4 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
 - 1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by form work, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.
 - 1. Provide a roughen interface with a 1/4", min, amplitude at construction joints in walls, slabs, and between walls and footings.
 - 2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- B. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.
- C. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
 - 1. Joint filler and sealant materials are specified in Section 030000.02 of these specifications.
- D. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4 of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic strips into fresh concrete until top surface of strip is flush with slab surface.
 2. Follow the directions of Insert Manufacturer for finishing the slab and joints.
- E. If joint pattern not shown, provide joints not exceeding 15' in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).
1. Joint sealant material is specified in Section 030000.02 of these specifications.

3.6 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto. Electrical conduit shall not be embedded in concrete.
- B. Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- C. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.7 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

3.8 CONCRETE PLACEMENT

- A. Preplacement Inspection: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

- B. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 3. Maintain reinforcing in proper position on chairs during concrete placement operations.
- E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.
 - a. The concrete shall be maintained within this temperature range for not less than seven (7) days.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials or against cold reinforcing steel.
 3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineers.

3.9 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For formed concrete surfaces not exposed-to- view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed; provide smooth rubbed finish to smooth form finish. Refer to "Concrete Surface Repairs."
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment.
 1. Scarify or roughen entire surface by grinding or similar effective means.
 2. Combined one part Portland cement to 1-1/2 parts fine sand by volume and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.
 3. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
 4. Repeat the above process if necessary to fill voids or bug holes and obtain a consistent match to adjacent surfaces, subject to acceptance of the Engineer.
- D. Grout Cleaned Finish: Provide grout cleaned finish on scheduled concrete surfaces which have received smooth form finish treatment.
 1. Scarify or roughen entire surface by grinding or similar effective means.
 2. Apply Thoroseal plaster mix coating by Thoro System Products or approved equivalent with an approximate thickness of 1/8-inch to 1/4-inch.
 3. Follow the manufacturer's recommendations and guidelines regarding surface preparation, application methods and curing.
 4. Repeat the above process if necessary to fill voids or bug holes and obtain a consistent match to adjacent surfaces, subject to acceptance of the Engineer.

- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
 - 1. After placing slabs, plane surface to tolerances for floor flatness F(F) 15 and floor levelness F(L) 13, measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both, Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F(F) 18 F(L) 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
 - 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F(F), 20 and F(L) 17, measured according to ASTM E1155. Grind smooth surface defects which would telegraph through applied floor covering system.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
- E. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

- F. Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.
1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
 2. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.
- G. Colored Wear-Resistant Finish: Provide colored wear-resistant finish to monolithic slab surface indicated.
1. Apply dry shake materials for colored wear-resistant finish at rate of not less than 100 lbs. per 100 sq. ft., unless greater amount is recommended by material manufacturer.
 2. Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications, and embed by power floating.
 3. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.11 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete from rapid moisture loss before and during finishing operations.
1. The evaporation graph, Figure 1, of ACI 308 - Curing Concrete, shall be used to determine the evaporation rate during concrete placement. If the rate of evaporation equals or exceeds 0.2 lbs/sq.ft./hr., steps shall be taken to prevent excessive evaporation from the surface.
 2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.
 - a. Initial curing may be any of the methods listed herein that maintain a satisfactory moisture content and temperature.
 3. Begin final curing procedures, if they differ from initial curing, immediately following initial curing and before concrete has dried. Continue curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of all structural concrete as herein specified.
1. Provide moisture curing by following methods.
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Cover concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows:

- a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

C. Provide curing and sealing compound to pavement, walks, and curbs only, as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours) and after surface water sheen has disappeared. Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

E. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing methods.

1. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.12 SHORES AND SUPPORTS

- A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.
- B. Extend shoring from ground to roof for structures four (4) stories or less, unless otherwise permitted.
- C. Extend shoring at least three (3) floors under floor or roof being placed for structures over four (4) stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.
- D. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.
 1. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.13 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for five (5) days after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members. Lab cured cylinders will not be considered.
- C. Form facing material may be removed five (5) days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.14 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new form work.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

3.15 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
 - 1. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled. Cure concrete as herein specified.

- E. Reinforced Masonry: Provide concrete grout conforming to ASTM C476 for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.16 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
 - 1. Saw-cut out honeycomb, rock pockets, voids over 1/4" in any dimension, down to solid concrete but, in no case to a depth of less than 1." Make edges of cuts slightly undercut to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
 - 2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with Portland Cement patching mortar, or precast cement cone plugs secured in place with bonding agent. When other materials are used, apply them in accordance with manufacturer's recommendations.
 - 1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
 - 2. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
 - 3. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
 - 4. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
 - 5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.
 - 6. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
8. Perform structural repairs with prior approval of Engineer or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
9. Repair methods not specified above may be used, subject to acceptance of Engineer.
10. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material.

3.17 THROUGH SECTION CONCRETE CRACK REPAIRS

A. Sealing through wall or slab cracks.

1. Seal cracks for a water-tight or structurally bonded repair with epoxy or chemical grouting procedures.
 - a. The Contractor shall make proper repairs with epoxy injection or chemical injection with a moisture reactive hydrophilic polyurethane foam grout, as directed by the Engineer.

ADDENDUM
EXAMPLE FORM A

CONCRETE SUPPLIER: _____

PROJECT: _____ CONTRACTOR: _____

MIXTURE ID: _____ SPECIFIED f'_c : _____ PSI

MATERIAL MIXTURE PROPORTIONS lbs-mass/cu.yd. (pcy)

1.0 Cement Type _____ Source: _____

Sp. Gr. _____ pcy _____ cu. ft.

1.1 Other Cementitious Materials: _____ Class: _____ Source: _____

Sp. Gr. _____ pcy _____ cu. ft.

2.0 Aggregate (No. 1) Type: _____ Size: _____ Source: _____

SSD Sp. Gr. _____ pcy _____ cu. ft.

Dry Rodded Unit Wt.: _____ pcf

Alternate (No. 1) Lightweight Aggregate Type: _____ Size: _____ Source: _____

Sp. Gr. Factor _____ over dry pcy _____ cu. ft.

Loose Unit Wt. _____ pcf Estimated Wet _____ pcf

2.1 Aggregate (No. 2) Type: _____ Size: _____ Source: _____

SSD Sp. Gr. _____ pcy _____ cu. ft.

Dry Rodded Unit Wt.: _____ pcf (If Fine Sized - FM _____)

2.2 Aggregate (Nos. 3, 4, n) Type: _____ Size: _____ Source: _____

SSD Sp. Gr. _____ pcy _____ cu. ft.

Dry Rodded Unit Wt.: _____ pcf

3.0 Water: _____ gal. _____ pcy _____ cu. ft.

EXAMPLE FORM A (CONTINUED)

4.0 Admixtures expressed as fluid ounces/cubic yard, and estimated range

Source: _____ Name: _____ Type _____ oz

Source: _____ Name: _____ Type _____ oz

Source: _____ Name: _____ Type _____ oz

Total Admixture Liquid Vol. _____ cu. ft.

(*) Note: Show volume in 4.0 if not included in cubic feet of air or water.

5.0 Other Materials - fibers, color pigment or other additions

Sp. Gr. _____ pcy _____ cu. ft.

Total Mixture Mass and Volume: _____ pcy _____ cu. ft.

Fresh Concrete Properties

Coarse & Fine Aggregate Gradation

Percent Passing

Slump _____ +/- _____ in.

Sieve Size

Aggregate No.

Unit Weight _____ pcf

2 in.

1 2 3 4 Combined

Air Content _____ +/- _____ %

1-1/2 in.

1 in.

3/4 in.

1/2 in.

If Trial Batch Data -

3/8 in.

Identify Batch No. _____

No. 4

Batch Date _____

No. 8

Concrete Temp. _____ °F

No. 16

Comp. Strength-Average _____ °F

No. 30

EXAMPLE FORM A (CONTINUED)

7 day avg. _____psi

No. 50 _____

28 day avg. _____psi

No. 100 _____

No. 200 _____

Comments: _____

Signature: _____ Date: _____

Title: _____

Organization: _____

EXAMPLE FORM B

CONCRETE SUPPLIER: _____

MATERIAL TRAIL BATCH NUMBER - proportions per cubic yard

1 2 3 4

1.0 Cement Source: _____

Type _____ lb lb lb lb

1.1 Other Cementitious Material Sources: _____

Type _____ lb lb lb lb

2.0 Aggregate No. 1 Size _____ Source: _____

SSD _____ lb lb lb lb

Alternate No. 1 Lightweight Aggregates Type _____ Source: _____

Sp. Gr. Factor _____

Oven Dry _____ lb lb lb lb

Wet _____ lb lb lb lb

2.1 Aggregate No. 2 Size _____ Source: _____

SSD _____ lb lb lb lb

2.2 Aggregate Nos. 3, 4, n) Size _____ Source: _____

SSD _____ lb lb lb lb

3.0 Water _____ lb lb lb lb

4.0 Admixtures Source: _____

_____ Type _____ oz oz oz oz

_____ Type _____ oz oz oz oz

_____ Type _____ oz oz oz oz

EXAMPLE FORM B (CONTINUED)

5.0 Other Materials

_____ Type _____ lb _____ lb _____ lb _____ lb

Total Mass: _____ lb _____ lb _____ lb _____ lb

Total Mass/cy: _____ pcy _____ pcy _____ pcy _____ pcy

Relative Cubic Yard Volume: _____ cy _____ cy _____ cy _____ cy

Water-Cementitious Material Ratio:

Fresh Concrete Properties

TRAIL BATCH NUMBER

	<u>## -1</u>	<u>## -2</u>	<u>## -3</u>	<u>## -4</u>
Slump-inches	_____	_____	_____	_____
Air-Content %	_____	_____	_____	_____
Unit Wt. pcf	_____	_____	_____	_____
Concrete Temp. °F	_____	_____	_____	_____
Compressive Strength Results (ASTM C192, C39) or Other Specified Test Requirements				
7 days	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Average (7 day)	_____	_____	_____	_____

EXAMPLE FORM B (CONTINUED)

28 days

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Average (28 day)

_____	_____	_____	_____

Water-Cementitious Material Ratio:

_____	_____	_____	_____

Signature: _____ Date: _____

Title: _____

Organization: _____

END OF SECTION 030000

SECTION 030000.02 - EXPANSION AND CONSTRUCTION JOINTS

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 the work of this section.

1.2 DESCRIPTION OF WORK

- A. This work includes furnishing and installing all joints where necessary.
- B. In general, the work may include the following types of joints:
 - 1. Types A, D, E, F, H and J Expansion Joint
 - 2. Types B and L Waterstop Construction Joint
 - 3. Types C and G Isolation Joints
 - 4. Type K Construction Joint
 - 5. Type CJ Control Joint
- C. Refer to the contract drawings and specifications for locations and details of the joints to be used.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The non-extruding preformed filler for joint Types A, C, D, E, F, J, L, and M shall conform to the requirements of "Standard Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction" ASTM D 1752, Type I, Sponge Rubber. Preformed filler shall be "Sponge Rubber" as manufactured by W.R. Meadows Company, Everlastic 1300 Series concrete gray sponge by Williams Products, Inc. or equal.
- B. The preformed filler for joint Type H shall conform to the requirements of ASTM D 1752, Type III, self-expanding cork. Self-expanding cork shall be as manufactured by W.R. Meadows Company, or equal.
- C. Preformed filler strips up to one (1) inch thickness shall be made as a single piece. Strips greater than one (1) inch thickness shall be fabricated by cementing together a minimum number of pieces. All cementing or vulcanizing shall be done at the point of manufacture.
- D. The joint sealer shall be cold applied in accordance with manufacturer's recommendations.
 - 1. Where the joint is not in contact with water, "No-Trak" as manufactured by A.C. Horn, Inc., "Gardox" by W.R. Meadows, Inc., or equal, shall be used.
 - 2. Where the joint is in contact with water, "Sikaflex-IA" as manufactured by Sika Corporation, or equal shall be used.
- E. Extruded polyvinyl chloride (PVC) waterstops for Type "C" joint shall be nine (9) inches in width, not less than three-eighths (3/8) inch in thickness; Type "L" joint shall be four (4) inches wide, not less than three-sixteenths (3/16) inch in thickness; Types "G" and "J" joint shall be six (6) inches in

width, not less than three-eighths (3/8) inch in thickness and all waterstops shall be of corrugated construction. Types "C", "G", and "J" shall have a center bulb and corrugated ends. The waterstops shall be made continuous by use of factory made fittings and field jointing by heat welding in accordance with the manufacturer's recommendations. PVC waterstops shall be as manufactured by Vinylex Corporation, Greenstreak Products, or equal. Provide a test report for each lot of waterstops shipped to the job site.

- F. Type "B" joints shall be as detailed on the drawings. The preformed plastic waterstops shall meet or exceed all requirements of Federal Specifications SS-S-210A, "Sealing Compound for Expansion Joints". Such preformed plastic waterstop shall be "Snyko-Flex" waterstop manufactured by Synko-Flex Products, 2100 Travis Street, Houston, Texas, or an approved equivalent.
- G. Elastomeric bearing pad in joint Type "G" shall be 50 durometer Everlastic 1200 Series Neoprene as manufactured by William Products, Inc., or equal.
- H. Type "K" joint shall be constructed as detailed on the drawings.
- I. Type "CJ" premolded insert shall be "Speed-E-Joint" by W.R. Meadows, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Form work shall be designed to hold the preformed filler in alignment within the joint during and after concrete is poured. General description of the joints are as follows:
 - 1. Type "A", "D", "E" and "F" expansion joints shall consist of non-extruding preformed filler only to separate the adjoining faces of concrete without the use of a waterstop. The top shall be finished by a joint sealer for slabs. Unless otherwise shown, preformed filler shall be three-fourths (3/4) inch thick and shall be of a width equal to the faces of concrete which it is separating. Where required, the preformed filler shall be attached to concrete by the use of an approved adhesive. Apply bond breaker to edge of preformed filler material only, prior to placing joint sealer. The joint sealer shall bond only to the concrete surfaces.
 - 2. Type "B" waterstop construction joint shall consist of a standard construction joint and waterstop as detailed on the drawings.
 - 3. Types "C" and "J" joint shall consist of preformed filler material, waterstop and joint sealer as detailed on the drawings.
 - 4. Type "G" joint shall consist of an elastomeric bearing pad and waterstop as detailed on the drawings.
 - 5. Type "H" joint shall consist of self-expanding cork to separate the adjoining faces of concrete without the use of a waterstop. The top shall be finished by a joint sealer.
 - 6. Type "CJ" Control joints shall be made by inserting a removable preformed insert to create a joint which is then filled with a joint sealer, if required.
 - 7. Type "K" joint shall consist of a standard construction joint, a saw cut, and joint sealer as detailed on the drawings.
- B. PVC waterstops shall be wired to the reinforcing steel every 12" to prevent misalignment during concreting.

END OF SECTION 030000.02

SECTION 032313 – CIRCULAR, PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The qualifications and requirements for the construction of an AWWA D110 Type III wire wound, prestressed, concrete circular tank with a flexible base. This includes all reinforcing, concrete work, prestressing, appurtenances, subgrade preparation, backfilling, disinfection and testing directly related to the tank; unless otherwise specified.
2. Tank design and construction shall be performed in accordance with the requirements of this section as well as the Drawings. The Supplier/Subcontractor/Contractor shall coordinate as necessary with the Tank Manufacturer to complete the design and construction of the tank and acquire all necessary technical specifications and Drawings.

B. Related Requirements:

1. Section 333100 – Sanitary Sewer System.
2. Section 432139 – Submersible Pumps.
3. Section 464614 – Circular Tank Flushing System.

1.2 REFERENCE STANDARDS

- A. ACI 301 Specifications for Structural Concrete
- B. ACI 305 Hot Weather Concreting
- C. ACI 306 Cold Weather Concreting
- D. ACI 309R Guide for Consolidation of Concrete
- E. ACI 318 Building Code Requirements for Reinforced Concrete and Commentary
- F. ACI 350 Code Requirements for Environmental Engineering Concrete Structures and Commentary
- G. ACI 350.3 Seismic Design of Liquid Containing Concrete Structures and Commentary
- H. ACI 372R Design and Construction of Circular Wire- and Strand Wrapped Prestressed Concrete Structures

- I. ACI 506R Guide to Shotcrete
- J. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- K. ASTM A416 Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
- L. ASTM A475 Standard Specification for Zinc-Coated Steel Wire Strand
- M. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- N. ASTM A706/A706M Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- O. ASTM A722/A722M Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
- P. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- Q. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
- R. ASTM C33 Standard Specification for Concrete Aggregates
- S. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- T. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- U. ASTM C618, Type F Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- V. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 Ft. – lbf/ft³) 600 kN-m/m³)
- W. ASTM C920 Specification for Elastomeric Joint Sealants
- X. ASTM D1056 Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber
- Y. ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete and Shotcrete
- Z. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

- AA. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 Ft. – lbf/ft³) 2700 kN-m/m³)
- BB. ASTM D2000 Classification System for Rubber Products in Automotive Applications
- CC. ASCE Standard 7 Minimum Design Loads for Buildings and Other Structures
- DD. AWWA C652 Standard for Disinfection of Water-Storage Facilities
- EE. AWWA D110 Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks
- FF. TID-7024, Dynamic Pressure on Fluid Containers of Nuclear Reactors and Earthquakes
- GG. US Army Corps of Engineers Specification CRD-C-572, Specification for PVC Waterstop

1.3 SUBMITTALS

- A. Complete plan, elevation, and sectional views showing critical dimensions including:
 - 1. Size, location and number of all reinforcing bars.
 - 2. Thickness of all parts of the tank structure including floor connections, core wall and cover coat.
 - 3. Prestressing schedule including number and placement of prestressing wires or strands on the tank wall and total applied force per foot of wall height.
 - 4. Location and details of all accessories required.
 - 5. Complete tank design including floor design either supported on Deep foundation elements or shallow mat foundation as required for design.
- B. Concrete design mixes including ingredient proportions, minimum cementitious content, and water/cementitious ratio in accordance with these specifications.
- C. Warranty document in Owner's name in accordance with Contract Documents.
- D. Test Reports: Submit concrete strength reports for 7-day and 28-day breaks.
- E. Structural calculations signed and sealed by a professional engineer registered in Ohio.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Following completion of the tank, tank installer shall submit to the Engineer a full set of record drawings which shall include actual location layout and final configuration of tank and accessories. These Drawings shall be incorporated into the Engineers Record Drawings for the project.

1.5 QUALITY ASSURANCE

- A. Singular Responsibility: It is the intent of this specification to require single party responsibility for the design and the construction of the tank. The tank design and construction shall be performed by an established Tank Contractor of recognized ability, having in its own name at least ten years of experience and a minimum of at least twenty AWWA D110 Type III wire wound prestressed concrete core wall as specified herein. The design and construction of all aspects of the foundation, floor slab, wall, prestressing, shotcrete along with the wire wound circular prestressed tank shall be performed by the Tank Contractor. The Tank Contractor may subcontract labor for reinforcing steel installation and for concrete slab placement under the Tank Contractor's direct supervision. The design, construction, testing and quality control of the deep foundation/rock anchor system shall be the responsibility of the Tank Contractor. The Tank Contractor may subcontract labor for the deep foundation/rock anchor installation under the Tank Contractor's direct supervision.

1.6 QUALIFICATIONS

- A. All tank work shall be performed by a company that specializes in the design and construction of wire wound prestressed concrete tanks using the method of circumferential prestress reinforcing and with proven capability of meeting all the requirements of these specifications and AWWA D110. No company is considered qualified unless it has designed and built in its own name at least twenty AWWA D110 prestressed concrete tanks with a Type III core wall in the last ten years which have been in successful service for at least five years. Experience in the design and construction of tanks with a Type I, II or IV core wall is not acceptable.
- B. The Tank Contractor shall have in its employ a design professional engineer with a minimum of ten years of experience in the design of AWWA D110 Type III core wall tanks, registered in the state the tank is to be constructed. The Tank Contractor shall have in its employ a design professional engineer with a minimum of ten tanks with an AWWA D110 Type III core wall in the past five years. The design engineer shall have been the engineer of record for a minimum of ten tanks with an AWWA D110 Type III core wall.
- C. Experience in the design and construction of tanks with an AWWA D110 Type I, Type II or Type IV core wall, tanks having a fixed wall base, mild-steel reinforced core wall or tanks having a core wall incorporating internal stressing systems is not acceptable.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacturers:

1. DN Tanks.
2. Or Approved Equal.

B. Design Criteria:

1. The prestressed concrete tank shall be designed and constructed in accordance with the provisions of AWWA D110 Standard for Wire Wound Circular Prestressed-Concrete Water Tanks: Type III; ACI 350, ACI 350.3, ASCE 7 and IBC.
2. Requirements and Loadings:
 - a. Capacity: 1.76 million gallons.
 - b. Dimensions: 100 feet inside diameter, 30 feet side water depth.
 - c. Dead Load: shall be the estimated weight of all permanent imposed loads. Unit weight of concrete: 150 pcf; steel: 490 pcf.
 - d. Liquid Load: Unit weight of liquid: 62.4 pcf.
 - e. Wind Loads: shall be as required by ASCE 7.
 - f. Geotechnical information: Lateral earth pressure, backfill density, bearing pressures, anticipated settlements, subbase coefficient of friction, ground water elevation and seismic site class per Geotechnical Report
 - g. Seismic Criteria:
 - 1) Seismic design shall be based on the applicable sections of AWWA D110, ASCE 7 and the local jurisdictional building code. Impulsive and convective forces, as well as fluid spectral velocity shall be calculated utilizing each code and the maximum value of each component shall be utilized.
 - 2) Risk Category: IV
 - 3) Sloshing: The sloshing height shall be calculated using AWWA D110 and ASCE 7.
3. The Type III tank core wall is based on the following design criteria and requirements:
 - a. The prestressed tank wall shall be considered as a cylindrical shell with partial edge restraint and rest on a rubber bearing pad allowing free radial movement. A fixed base wall will not be allowed.
 - b. Core wall to be composite precast concrete with steel diaphragm and vertical mild steel reinforcement. Steel wall slot plates shall be utilized between precast panels on the exterior face of the wall along with a ½ inch thick shotcrete cover over the diaphragm and plates.
 - c. Minimum precast wall panel thickness shall be 6 inches.
 - d. Circumferential prestressing to be continuous except at wall penetrations.
 - e. Diaphragm steel may be considered as contributing to the vertical reinforcement of the wall.
 - f. The core wall is that area of the wall interior to all circumferential prestressing.
 - g. Shotcrete thickness shall provide a clear cover over the circumferential prestressing of at least 1/4 inch on intermediate layers. The minimum final shotcrete cover over the circumferential prestressing wire shall be 1 inch.

- h. For wire wound tanks, a stress plate shall be required at all above grade locations where prestress wires are displaced 24 inches or greater. The stress plate shall be designed to transfer stress across the opening.
- i. No reduction in ring compression or tension in the tank core wall will be taken due to restraint at the bottom.
- j. Tank wall systems based on jack-operated cable or rod type tendons, involving the circumferential movement of prestressing steel relative to the wall surface shall not be considered. Circumferential systems relying on strand cables placed inside of ducts (cast in the core wall or manually around the exterior) will not be accepted.
- k. Shotcrete, cast in place or other alternative core walls are not permitted.
- 4. Floor Slab:
 - a. The design of the deep foundation/rock anchor system shall be in accordance with the recommendations contained in the geotechnical engineering report and specifications. The deep foundation/rock anchor design and construction drawings shall be prepared by a licensed professional engineer.
 - b. Tank Foundation Slab:
 - 1) The tank foundation slab shall be designed to accommodate and transmit the loads from the tank structure and contents to the deep foundation elements. Deep foundation elements shall have a minimum 3 inch embedment into the foundation slab.
 - 2) The tank foundation slab shall be designed incorporating the Environmental Durability Factor and shall comply with ACI 350.
 - 3) Reinforcement shall be conventional reinforcing bars. Minimum cross sectional area ratio of reinforcement to concrete shall be in conformance with ACI 350 for the tank foundation slab.
 - 4) Poly-propylene or cellulose fibers may be used at the Tank Contractor's discretion.
- 5. Wall Base:
 - a. Wall to foundation connection to utilize a continuous 9" minimum vertical PVC ribbed centerbulb waterstop.

2.2 SUPPLIED BY TANK CONTRACTOR

- A. Concrete and Shotcrete:
 - 1. Concrete and shotcrete shall conform to and be proportioned in accordance with ACI 301 and 506 respectively, except as modified herein.
 - 2. Cement shall be Portland cement Type I, Type II, Type III or Type IV.
 - 3. Admixtures, other than air-entraining, superplasticizers, hydration stabilizers, shrinkage reducing and water reducing admixtures will not be permitted unless approved by the Engineer.
 - 4. If air entrainment is utilized, the total volumetric air content of the concrete or shotcrete before placement shall not exceed 8% ($\pm 1.5\%$) as determined by ASTM C173 or ASTM C231.
 - 5. Curing compound to be membrane forming and in accordance with ASTM C309.

6. Concrete for tank wall construction shall have a minimum compressive strength of 4,500 psi at twenty-eight days and a maximum water to cementitious ratio of 0.42.
7. Concrete for the tank floor, footings, pipe encasement and all other work shall have a minimum compressive strength of 4,500 psi at twenty-eight days, does not require air-entrainment and shall have a maximum water to cementitious ratio of 0.42. The coarse and fine aggregate shall meet the requirements of ASTM C33. Superplasticizers, water-reducing, and shrinkage reducing (if applicable) admixtures shall be incorporated into the floor concrete. If fibers are used, they shall be virgin polypropylene or cellulose fibers, Microfiber by Grace, Fibermesh 150-e3 by Propex, UltraFiber 500 by Buckeye, or equal. Fiber lengths shall be a maximum of $\frac{3}{4}$ inches. The amount of fibers added to the concrete mix shall conform to the Manufacturer's recommendations.
8. Shotcrete used for core wall and prestressing wire cover shall consist of not more than three parts sand to one part Portland cement by weight. Final covercoat of shotcrete shall consist of not more than four parts sand to one part Portland cement by weight. Polypropylene fibers shall be included in the shotcrete used for the finish cover coat. Fibers shall be Fibercast 500 by Propex, Fibermesh or equal. Fibers shall be virgin polypropylene and comply with ASTM C1116 performance level I. Fiber length shall be $\frac{1}{4}$ inch. The amount of the fibers added to the shotcrete used for the finish cover coat shall conform to the Manufacturer's recommendations. Fly ash may be incorporated into the finish cover coat. If Fly ash is used, it shall conform to ASTM C618, Type F (or C). Shotcrete shall have a minimum strength of 4,500 psi at twenty-eight days and have a maximum water to cementitious ratio of 0.42.
9. Shotcrete Fine Aggregates:
 - a. The fineness modulus shall be between 2.7 and 3.4. A well-graded coarse sand shall be used for all shotcrete applications.
 - b. The gradation for the fine aggregates shall adhere to the "Grading No. 1" requirements listed in "Table 1.1 – Grading Limits for Combined Aggregates" of ACI 506.
10. All concrete and shotcrete for the tank wall and dome ring shall have a maximum water soluble chloride ion concentration of 0.06% by weight of cementitious. All other concrete which has encased uncoated steel shall have a maximum water soluble chloride ion concentration of 0.1% by weight of cementitious.
11. If utilizing hydration stabilizing admixture, the admixture may be applied after 90 minutes provided the w/c ratio is not exceeded and the slump and temperature remain consistent.
12. The wet mix process shall be utilized for shotcreting.
13. Rebound material shall not be reused in any form for shotcrete.

B. Reinforcing Steel:

1. Reinforcing steel shall be new billet steel Grade 60, as shown on the Drawings, meeting the requirements of ASTM A615. Welded wire fabric and weldable reinforcing steel shall conform to ASTM A1064 and ASTM A706, respectively
2. Reinforcing steel shall be accurately fabricated and shall be free from loose rust, scale, and contaminants, which reduce bond.

3. Rebar chair supports may be either steel with plastic tips, turned up legs, concrete dobies or plastic.
 4. Galvanized rebar to be Class 1 coating in accordance with ASTM A767 without chromate.
- C. Strand for Base Restraint Cables:
1. Base restraint cables shall be hot-dip galvanized seven-wire strand and shall be manufactured in accordance with ASTM A416 prior to galvanizing, and ASTM A475 after galvanizing. Only seven-wire strand will be allowed. All strands shall have a minimum weight of zinc coating of 0.85 ounces per square foot.
- D. Mortar Fill and Non-Shrink Grout:
1. Mortar fill and non-shrink grout shall have a minimum compressive strength of 4,000 psi at twenty-eight days, have a maximum water to cementitious ratio of 0.42 and meet all requirements for concrete contained in this specification.
- E. Steel Diaphragm and Wall Slot Steel:
1. The steel diaphragm shall conform to ASTM A1008 and shall be a minimum thickness of 0.017 inches. It shall be vertically ribbed with reentrant angles. The back of the channels shall be wider than the front, providing a mechanical keyway anchorage with the concrete and shotcrete encasement.
 2. Wall slot steel to be 10 gauge low carbon steel conforming to ASTM A569. Plate shall not be pickled or oiled.
- F. Circumferential Prestressing Steel:
1. Steel for prestressing shall be cold drawn, high carbon wire.
 2. The wire shall meet the requirements of ASTM A821 and have a minimum ultimate tensile strength of 210,000 psi.
 3. Splices for horizontal prestressing shall be ferrous material compatible with the reinforcement and shall develop the full strength of the wire. Wire splice and anchorage accessories shall not nick or otherwise damage the prestressing.
- G. Elastomeric Materials:
1. Floor to wall connection shall utilize a ribbed waterstop with centerbulb. Construction joints to utilize ribbed flat strip waterstops. Waterstops shall be polyvinyl chloride meeting the requirements of the Corps of Engineers Specification CRD-C 572.
 2. Bearing pads shall be neoprene or rubber.
 - a. Neoprene pads shall have a hardness of 40 durometer and shall meet the requirements of ASTM D2000 Line Call-Out M 2 BC 410 A1 4 B14 or M 2 BC 414 A14 C12 F17 for 40 durometer material.
 - b. Natural rubber bearing pads shall contain only virgin natural polyisoprene as the raw polymer and the physical properties shall comply with ASTM D2000 Line Call-Out M 4 AA 414 A1 3.
 3. Neoprene Sponge filler shall be closed-cell neoprene rubber conforming to ASTM D1056, Type 2, Class A, and Grade 1 or 3.

- H. Sealants:
 - 1. Polyurethane filler and sealant shall conform to ASTM C290 Type S.
 - 2. Polysulfide sealant will be a two or three component elastomeric compound meeting the requirements of ASTM C920 Type M. Sealants shall have permanent characteristics of bond to metal surfaces, flexibility, and resistance to extrusion due to hydrostatic pressure. Air cured sealants shall not be used.
- I. Exterior Coatings:
 - 1. Above grade exterior wall surfaces shall receive two coats of a non-cementitious, high build, 100% acrylic resin polymer such as "Tammscoat Smooth" textured protective coating, "Tnemec Envirocrete 156", "Sherwin Williams Loxon XP WP" or equal.
- J. Appurtenances:
 - 1. Pipe: Refer to Specification Section 333100 – Sanitary Sewer System.
 - 2. Tank Drain Pumps: Refer to Specification Section 432139 – Submersible Pumps.
 - 3. Tank Cleaning System: Refer to Specification Section 464614 – Circular Tank Flushing System.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive Work.
- B. Tank Contractor to conform to and enforce all Local and Federal OSHA safety rules and regulations.

3.2 PREPARATION

- A. The Site Work Contractor shall excavate to such depths and widths to provide adequate room for tank construction and as required in the geotechnical report. All trees, shrubs, brush, stumps, roots, and other unsuitable material shall be removed to a minimum distance of 12 feet outside the edge of the tank foundation, plus additional areas necessary for the tank construction. The working area surface shall be at an elevation of 12" below the top of foundation.
- B. The excavation shall be dewatered as required during construction. The dewatering method used shall prevent disturbance of the tank foundation soils.
- C. In the event the subgrade material is disturbed or over excavated by the Site Work Contractor during excavation, at the direction of the Engineer, it shall be removed and replaced with compacted select fill.

- D. A leveling base material consisting of a minimum 6-inch-thick layer of compacted select fill shall be placed beneath the entire tank foundation. Select fill shall consist of a clean, well graded, angular or sub-angular, $\frac{3}{4}$ " (maximum) base material. The base material shall permit free drainage without the loss of fines or intermixing with subgrade material by limiting the amount of material that passes the No. 200 sieve to a maximum 8 percent by weight of the total base material. Select fill shall be placed in layers not exceeding 6 inches and compacted to a minimum density equal to 95% of the maximum laboratory density in accordance with ASTM D1557. Field testing for density achieved shall be in accordance with ASTM D1556 or D2922. In lieu of select fill, a uniformly graded $\frac{3}{4}$ inch minus crushed stone in accordance with ASTM C33 #67 stone may be used as the leveling base material. Crushed stone shall be placed in layers not exceeding 9 inches and compacted with at least two passes in each direction with vibratory roller compaction equipment. Compaction shall be inspected, and verification of compaction effort shall be documented by an approved testing agency. The surface elevation of the leveling base shall be fine graded to a tolerance of plus zero inches to minus $\frac{1}{2}$ inch over the entire foundation areas. Fine grading tolerances for floor pipe encasements shall be plus zero inches to minus 6 inches.
- E. All fill materials for backfill shall be approved by the Engineer and/or Owner.
1. Rock or concrete spoils (greater than 6 inches) shall not be used in backfill within 2 feet of the tank wall.
 2. Earth moving equipment limits for tank backfill installation:
 - a. Within 5 ft of tank wall, only hand operated equipment.
 - b. Between 5 and 15 feet: Maximum weight of 40,000 lbs for non-vibratory and maximum weight of 20,000 lbs for vibratory machinery.

3.3 INSTALLATION

- A. Floor:
1. Prior to placement of the floor reinforcing, a 6 mil polyethylene moisture barrier shall be placed over the leveling base material. Joints in the polyethylene shall be overlapped a minimum of 6 inches.
 2. Prior to placement of the floor concrete, all piping that penetrates the floor shall be set and encased in concrete.
 3. The vertical waterstop shall be placed and supported so that the bottom of the center bulb is at the elevation of the top of the footing. The waterstop shall be supported without puncturing any portion of the waterstop other than pre-manufactured holes, grommets or hog rings for tying at 12 inches o.c.. The waterstop shall be spliced using a thermostatically controlled sealing iron and each splice shall be inspected using a penknife prior to encasement in concrete. Spark testing of the welded joint shall be permitted.
 4. The floor shall be cured using blankets, flooding with water or curing compound. The floor shall remain saturated for a minimum of seven days if curing compound is not utilized.
- B. Wall:

1. The precast wall panel shall be constructed with a continuous waterproof steel diaphragm embedded in the exterior of the precast panel. Horizontal joints in the diaphragm will not be allowed.
2. No holes for form ties, nails, or other punctures will be permitted in the wall.
3. Temporary wall openings may be provided for access and removal of construction materials from the tank interior.
4. Polyethylene sheeting shall be placed between successive pours to provide a high moisture environment and a long slow cure for the concrete.
5. Joints between precast wall panels shall be bridged with a steel plate edge sealed with polysulfide or polyurethane and filled with mortar as shown on the drawings. No through-wall ties will be permitted.
6. The steel diaphragm shall extend to within 1 inch of the full height of the wall panel with no horizontal joints. Vertical joints within a wall panel shall be roll seamed or otherwise fastened in a fashion that results in a firm mechanical lock.

C. Concrete and Shotcrete:

1. All concrete and shotcrete shall be conveyed, placed, finished, and cured as required by pertinent ACI standards.
2. Reinforcing steel shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips.
3. Weather Limitations:
 - a. Unless specifically authorized in writing by the Engineer, concrete and shotcrete shall not be placed without special protection during cold weather when the ambient temperature is below 35 degrees F, below 40 degrees F and falling or when the concrete is likely to be subjected to freezing temperatures before initial set has occurred and the concrete strength has reached 500 psi. The temperature of the concrete shall be maintained in accordance with the requirements of ACI 301 and ACI 306. All methods and equipment for heating and for protecting concrete in place shall be subject to the approval of the Engineer.
 - b. During hot weather, concreting and shotcreting shall be in accordance with the requirements of ACI 301, ACI 305 and ACI 506.
4. Finishes:
 - a. The floor slab shall receive a fresno or bullfloat at the option of the contractor. The top of the wall footing, exterior to the waterstop, shall receive a steel trowel or magnesium trowel finish.
 - b. The interior surface of the tank wall shall receive a horizontal light broom finish.
 - c. Exterior shotcrete shall receive a natural gun/nozzle finish.
 - d. For all formed concrete surfaces, all irregularities that project greater than 1/4" from the surface shall be ground off. All holes greater than 3/4" wide or 1/2" deep should be patched.
5. Concrete shall be cured using water methods, sealing materials, or curing compounds. Curing compounds shall not be used on surfaces to which decorative coatings, mortar, or shotcrete is to be applied.
6. Each prestress wire shall be individually encased in shotcrete.

7. Finish cover coat shotcrete shall be applied as soon as practical after the last application of wire coat.
8. Shotcrete shall be applied by, or under the supervision of, an ACI 506 certified nozzleman.
9. Total cover coat thickness shall be controlled by shooting guide wires. Vertical wires shall be installed under tension and spaced no more than two feet apart to establish uniform and correct coating thickness. Monofilament line (100 lb. test) or 18 or 20 gauge high tensile strength steel wire shall be used. Guide wires shall be removed after placement of the cover coat.
10. Testing:
 - a. For concrete placed in the precast panels or wall slots, a set of three cylinders shall be made for each truck load of concrete placed. For concrete placed in the floor, dome ring or dome slots, two sets of five cylinders for the first 50 cubic yards, and one set of five cylinders for every 100 cubic yards thereafter placed in the same day. Two cylinders shall be tested at seven days, two at twenty-eight days, and one held as a spare.
 - b. Slump, air content and temperature testing shall be performed on each truck where cylinders are taken.
 - c. Testing of shotcrete shall be in accordance with ACI 506, except as specified herein. One test panel shall be made for each of the following operations: core wall, wire or strand cover, and cover coat. Test panels shall be made from the shotcrete as it is being placed. The method of making a test sample shall be as follows: A frame of wire fabric (1 foot square, 3 inches in depth) shall be secured to a plywood panel and hung in the location where shotcrete is being placed. This vertical form shall be filled in layers. After twenty-four hours, the fabric and plywood backup shall be removed and the sample slab placed in a safe location at the site.
 - d. The shotcrete sample slab shall be cured in a manner identical with the regular surface application. The sample slab shall be sent to the testing laboratory. Nine 3 inch cubes shall be cut from the sample slab and subjected to compression tests in accordance with current ASTM Standards. Three cubes shall be tested at the age of seven days, three shall be tested at the age of twenty-eight days, and three shall be retained as spares.
 - e. All testing shall be in accordance with ASTM C31 and C39 and shall be conducted by an independent testing agency approved by the Engineer.

D. Circumferential Prestressing:

1. Prestressing wire shall be placed on the wall with a machine capable of consistently producing a stress in the wire within a range of minus 7% to plus 7% of the stress required by the design. No circumferential movement of the prestressing along the tank wall will be permitted during or after stressing. Stressing may be accomplished by drawing the wire through a die or by another process that results in uniform stress throughout its length.
2. Ends of individual coils shall be joined by suitable steel splicing devices capable of developing the full strength of the prestressing wire.
3. Circumferential stressing systems based on jack-operated cable or rod-type tendons will not be allowed.

4. Minimum clear distance between prestressing wire is 5/16 inch or 1.5 wire diameters, whichever is greater.
5. The Tank Contractor shall furnish a calibrated stress recording device, which can be recalibrated, to be used in determining the wire stress on the wall during and after the prestressing process. At least one stress reading per vertical foot or one stress reading for every roll of prestressing, whichever is greater, shall be taken after the wire has been applied on the wall. The Tank Contractor shall keep a written record of stress readings. All stress readings shall be made on straight lengths of wire. If applied stresses fall below the design stress in the steel, additional wire will be provided to bring the force on the core wall up to the required design force. If the stress in the steel is more than 7% over the required design stress, the wrapping operation should be discontinued, and satisfactory adjustment made to the stressing equipment before proceeding.

E. Exterior Coating:

1. All Work shall be performed by workmen skilled in the application of these types of products. The Manufacturer's application instructions shall be submitted to the Engineer for approval. The Contractor shall confer with the Manufacturer's representatives regarding application techniques and shall follow the Manufacturer's instructions implicitly.
2. The concrete surface to be coated shall be clean, free of all laitance, dirt, grease, or other foreign materials. All defective surfaces shall be filled and/or repaired. Application shall be in full accordance with the manufacturer's instructions or as amended by the Engineer.

3.4 TESTING

- A. Prior to backfill placement and placing tank in service, the tank shall be leakage tested.
- B. Testing shall require that the tank be filled with water furnished by the Contractor.
- C. The tank shall remain filled for a period of at least 48-hours to allow for absorption and initial settlement.
- D. The liquid volume loss for a period of 24 hours shall not exceed one-tenth of one percent on the tank capacity after accounting for evaporation and precipitation:
 1. If the liquid volume loss exceeds this amount, leakage shall be considered excessive and the tank shall be repaired and retested.
 2. Or, if during the testing, damp spots or seepage is present on areas exposed to view, the tank shall be repaired and retested.
 3. All repair procedures shall be approved by the Engineer.

END OF SECTION 032313

SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.
 - 2. Concrete building brick.
 - 3. Face brick.
 - 4. Mortar and grout.
 - 5. Steel reinforcing bars.
 - 6. Masonry joint reinforcement.
 - 7. Ties and anchors.
 - 8. Embedded flashing.
 - 9. Miscellaneous masonry accessories.
 - 10. Masonry cell insulation.
- B. Related Sections:
 - 1. Division 03 - Concrete.
 - 2. Division 08 - Openings.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include data on material properties.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing per ASTM C 67.
 - e. For masonry units include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- D. 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 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

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

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: Provide CMUs that have been manufactured within 500 miles (800 km) of Project site from aggregate and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. 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.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 4. Faces: Provide color and texture matching the range represented by Architect's sample.
- D. Concrete Building Brick: ASTM C 55.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.31 MPa).
 - 2. Density Classification: Normal weight.
 - 3. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 7-5/8 inches (194 mm) long.

2.3 BRICK

- A. Regional Materials: Provide brick that has been manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

- B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
1. Products: Face Brick
 2. Grade: SW.
 3. Type: FBX or HBX.
 4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m)
 8. Provide brick as indicated on the Architectural drawings.
- D. Building (Common) Brick: ASTM C 62, Grade SW.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1700 psi (11.72 MPa).

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Portland cement: ASTM C 150, Type I/II, except Type III may be used for cold-weather construction. Cement shall contain less than 0.60 percent alkalis. Provide natural color or white cement as required to produce mortar color indicated.
- C. Grout: Provide a 3,000-psi pea gravel concrete mix. Reference specification 030000 for addition information.
- D. Hydrated Lime: ASTM C 207, Type S.

- E. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- F. Masonry Cement: ASTM C 91.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capital Materials Corporation; Flamingo Color Masonry Cement.
 - b. CEMEX S.A.B. de C.V.; Brikset Type N Citadel Type S Dixie Type S Kosmortar Type N Richmortar Victor Plastic Cement.
 - c. Essroc, Italcementi Group; Brixment or Velvet.
 - d. Holcim (US) Inc.; Mortamix Masonry Cement Rainbow Mortamix Custom Buff Masonry Cement White Mortamix Masonry Cement.
 - e. Lafarge North America Inc.; Magnolia Masonry Cement Lafarge Masonry Cement Trinity White Masonry Cement.
 - f. Lehigh Cement Company; Lehigh Masonry Cement Lehigh White Masonry Cement.
 - g. National Cement Company, Inc.; Coosa Masonry Cement.
- G. Mortar Cement: ASTM C 1329.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
- H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
- I. Colored Cement Product: Packaged blend made from portland cement and hydrated and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Colored Portland Cement-Lime Mix:
 - 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond Portland & Lime.

- 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
- b. Colored Masonry Cement:
 - 1) Capital Materials Corporation; Flamingo Color Masonry Cement.
 - 2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
 - 3) Essroc, Italcementi Group; Brixment-in-Color.
 - 4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - 5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
 - 6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
 - 7) National Cement Company, Inc.; Coosa Masonry Cement.
 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 3. Pigments shall not exceed 10 percent of portland cement by weight.
 4. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- J. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- K. Aggregate for Grout: ASTM C 404.
- L. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- M. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
- N. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACM Chemistries; RainBloc for Mortar.
 - b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

O. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 1. All Walls: Hot-dip galvanized, carbon steel.
 2. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
 3. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 4. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 6. Provide in lengths of not less than 10 feet (3 m).
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus 1 side rod at each wythe of masonry 4 inches (100 mm) wide or less.
 2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
- E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized, carbon continuous wire.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 3. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.

2.7 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Peel-N-Seal.
 - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - 4) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
 - 5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 6) Hohmann & Barnard, Inc.; Textroflash.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

2.9 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 urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 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, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use the following unless otherwise indicated:
 - 1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Blok-Lok Limited; Cell-Vent.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 4) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 5) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 6) Wire-Bond; Cell Vent.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: 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. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 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 or mortar cement mortar unless otherwise indicated.
- B. 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.
 3. For mortar parge coats, use Type S.
 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required.
1. Pigments shall not exceed 10 percent of Portland cement by weight.
 2. Pigments shall not exceed 5 percent of mortar cement by weight.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Face brick.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 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 2000 psi (14 MPa).
 3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

2.12 MASONRY INSULATION

A. Plastic foamed in place insulation: Plastic foam to be two component liquid process, with a polymethylene carbamide compound resin, and a modified poly ammio reactant catalyst. Standard dry density of 0.7 pounds per cubic feet, and standard wet density between 2.5-3.4 pounds per cubic feet. Normal linear shrinkage during drying out period of 1.8 percent. Insulation to produce a minimum R-value of 8.21, based on 12-inch thick block, with a block density of 125 pounds per cubic feet. Insulation to be "Thermco Foam" as manufactured by Thermal Corporation of America, "Core-Fill 500" as manufactured by Tailored Chemical Products, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. 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.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 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 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.

C. Joints:

1. For all 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).

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond at High School. Match bond pattern at Elementary School.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay CMU's as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
 - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - 1. Provide individual metal ties not more than 8 inches (203 mm) o.c.
 - 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 - 3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm). Lap reinforcement a minimum of 6 inches (150 mm).
 - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
- 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.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick as follows:
 - 1. Build in compressible joint fillers where indicated.

3.9 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete lintels where shown.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. 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.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches (100 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
- E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.

3.11 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 other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- 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 ACI 530.1/ASCE 6/TMS 602 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) 12.67 ft. (3.86 m).

3.12 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - 8. Clean stone trim to comply with stone supplier's written instructions.
 - 9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.14 MASONRY CELL PLASTIC FOAM INSULATION

- A. Install plastic foam insulation into cavity to fill all void spaces completely, in accordance with manufacturer's installation instructions.

3.15 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Brick.
 - 2. Mortar materials.
 - 3. Ties and anchors.
 - 4. Embedded flashing.
 - 5. Accessories.
 - 6. Mortar mixes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type and color of brick and colored mortar.

1.3 MOCKUPS

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.

1.4 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.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, 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 and will be within 20 ft. vertically and horizontally of a walking surface.

2.2 BRICK

- A. Regional Materials: Verify brick is manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If transporting materials by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to Project site.
- B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- C. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area), Grade SW, Type FBS Type FBA or Type HBS Type HBA.
 - 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. Acme Brick Company.
 - b. Belden Brick Company (The).
 - c. Boral Bricks, Inc; Boral Limited.
 - d. Endicott Clay Products Co.
 - e. General Shale Brick, Inc.
 - f. Glen-Gery Corporation.
 - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
 - 3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 - 4. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 ft. or have a history of successful use in Project's area.
 - 5. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 - 6. Color and Texture: Color as selected by A/E, wire cut.

2.3 MORTAR MATERIALS

- A. Regional Materials: Acquire aggregate for mortar and grout, cement, and lime within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If transporting

materials by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to Project site.

- B. Masonry Cement: ASTM C91/C91M.
 - 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. Argos USA LLC.
 - b. Fairborn Cement Company.
 - c. Federal White Cement, Ltd.
 - d. Holcim (US) Inc.
 - e. Lafarge North America Inc.
 - f. Lehigh Hanson; HeidelbergCement Group.
 - g. Lehigh White Cement Company.
 - h. Quikrete; The QUIKRETE Companies, LLC.
 - i. Sakrete; CRH Americas, Oldcastle APG.
- C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 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. Davis Colors.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Lanxess Corporation.
 - d. Solomon Colors Inc.
- D. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Portland Cement-Lime Mix:
 - 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) Argos USA LLC.
 - 2) Holcim (US) Inc.
 - 3) Lehigh Hanson; HeidelbergCement Group.
 - 2. Colored Masonry Cement:
 - 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) Argos USA LLC.
 - 2) Cemex S.A.B. de C.V.
 - 3) Fairborn Cement Company.
 - 4) Holcim (US) Inc.
 - 5) Lafarge North America Inc.
 - 6) Lehigh Hanson; HeidelbergCement Group.

- E. Preblended Dry Mortar Mix: Packaged blend made from masonry cement, sand, mortar pigments, and admixtures and complying with ASTM C1714/C1714M.
 - 1. Preblended Dry Portland Cement Mortar Mix:
 - 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) Amerimix is a trademark of Bonsal American, an Oldcastle company.
 - 2) Quikrete; The QUIKRETE Companies, LLC.
 - 3) Sakrete; CRH Americas, Oldcastle APG.
 - 4) SPEC MIX, LLC.
 - 2. Preblended Dry Masonry Cement Mortar Mix:
 - 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) Amerimix is a trademark of Bonsal American, an Oldcastle company.
 - 2) SPEC MIX, LLC.
- F. Aggregate for Mortar: ASTM C144.
 - 1. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Water: Potable.

2.4 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 - 2. Stainless Steel Wire: ASTM A580/A580M, Type 304 .
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication .
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.0635-inch- thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch- thick steel sheet, galvanized after fabrication .
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized steel wire unless otherwise indicated.
4. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie and washer at face of insulation.
 - 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) FERRO Corporation.
 - 2) Hohmann & Barnard, Inc.
 - 3) PROSOCO, Inc.
 - 4) Wire-Bond.
5. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie.
 - 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) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Quality Steel and Wire LLC.
 - 4) Wire-Bond.
6. Masonry-Veneer Anchors; Slotted Plate: Sheet metal anchor section, with screw holes at top and bottom; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. Use self-adhering tape to seal penetration behind anchor plate.
 - 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) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Quality Steel and Wire LLC.
 - 4) Wire-Bond.

7. Masonry-Veneer Anchors; Slotted Plate with Prongs: Sheet metal anchor section, with screw holes at top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. Use self-adhering tape to seal penetration behind anchor plate.
 - 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) Hohmann & Barnard, Inc.
 - 2) Wire-Bond.
8. Masonry-Veneer Anchors; Single-Barrel Screw: Self-drilling, single-barrel screw designed to receive wire tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing and a coating to reduce thermal conductivity .
 - 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) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Rodenhouse Inc.
 - 4) Wire-Bond.
9. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with wingnut head designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing and a coating to reduce thermal conductivity .
 - 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) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
10. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless steel shank.

2.5 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "A/Eural Sheet Metal Manual" and as follows:
 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 , 0.016 inch thick.
 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.
 3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric, to produce an overall thickness of 40 mil.
 - 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) Hohmann & Barnard, Inc.
 - 2) PROSOCO, Inc.
 - 3) Wire-Bond.
 - 4) York Manufacturing, Inc.
 2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mil .
 - 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) Advanced Building Products Inc.
 - 2) Carlisle Coatings & Waterproofing Inc.
 - 3) GCP Applied Technologies Inc.
 - 4) Heckmann Building Products, Inc.
 - 5) Hohmann & Barnard, Inc.
 - 6) W. R. Meadows, Inc.
 - 7) Williams Products, Inc.
 - 8) Wire-Bond.
 3. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - 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) Hohmann & Barnard, Inc.
 - 2) Hyload; IKO Industries, Inc.
 - 3) Mortar Net Solutions.
 - 4) Wire-Bond.
 - b. Monolithic Sheet: Elastomeric thermoplastic flashing, 40 mil thick.
 - c. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 25 mil thick, with a 15-mil- thick coating of adhesive.
 - 1) Color: Tan/buff .
- C. Drainage Plane Flashing: Fabricate from stainless steel rubberized asphalt and drainage membrane to shapes indicated , including weep tabs, termination bar and drip edge. Provide flashing materials as follows:
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. Mortar Net Solutions.
 - b. STS Coatings, Inc.
 - c. York Manufacturing, Inc.
 2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 , 0.016 inch thick.

3. Rubberized Asphalt: 40 mil thick.
 4. Elastomeric Membrane: EPDM complying with ASTM D4637/D4637M , 40 mil .
 5. Fabricate continuous flashings in sections 60 inches long, minimum.
- D. 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.
- E. Termination Bars for Flexible Flashing: Stainless steel steel bars 1/8 inch by 1 inch .
- F. Termination Bars for Flexible Flashing, Flanged: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8-inch flange at top and bottom.

2.6 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or PVC.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.
 2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - 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) Advanced Building Products Inc.
 - 2) Heckmann Building Products, Inc.
 - 3) Hohmann & Barnard, Inc.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond.
 3. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
 - 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) CavClear; a division of Archovations, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keene Building Products.
 - 4) Mortar Net Solutions.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dimpled surface that prevent clogging with mortar droppings.

- 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) Advanced Building Products Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keene Building Products.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond.
 - 6) York Manufacturing, Inc.

2.7 MORTAR 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 or masonry cement mortar unless otherwise indicated.
 - 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 C270, Proportion Specification. Use Type N unless another type is indicated.
- D. 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 do not exceed 10 percent of portland cement by weight.
 - 2. Pigments do not exceed 5 percent of masonry cement by weight.
 - 3. Application: Use pigmented mortar for exposed mortar joints.

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.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

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 or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch 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 ft., or 1/2-inch 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch .

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 horizontal face dimensions at corners or jambs.
- C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
 - 5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 - 6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide not less than 1 inch of airspace between back of masonry veneer and face of sheathing or insulation.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.7 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and 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.
 - 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches.
 - 3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
 - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 - 5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use specified weep/cavity vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.9 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. Obtain A/E's approval of sample cleaning before proceeding with cleaning of masonry.
 2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.10 MASONRY WASTE DISPOSAL

- A. Excess Masonry Waste: Remove excess clean masonry waste that cannot be recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

SECTION 050531

ACCESS HATCHES, AND ACCESS DOORS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. Furnish all materials, labor, and equipment required to provide all gratings, floor plates, and hatches in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 055000 - Metal Fabrications

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. International Building Code
2. Aluminum Association Specifications for Aluminum Structures
3. Occupational Safety and Health Administration (OSHA) Regulations

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300, Submittals.
 1. Complete fabrication and erection Drawings of all gratings, access hatches, and access doors specified herein.
 2. Other submittals as required in accordance with Section 055000, Metal Fabrications, and Section 05050, Metal Fastening.

PART 2 -- PRODUCTS

2.01 METAL MATERIALS

- A. Metal materials used for gratings, floor plates, and hatches shall conform to Section 055000, Metal Fabrications, unless noted otherwise.

2.02 METAL FASTENING

- A. All welds and fasteners used for gratings, floor plates, and hatches shall be stainless steel conform to ASTM A304, unless noted otherwise.

2.03 ACCESS HATCHES

- A. Access hatches shall be aluminum unless noted otherwise.
- B. All access hatches shall be checker plate with an approved raised pattern, non-skid surface.
- C. Access hatches shall be designed to carry a minimum live load as noted in the construction document.
 - a. Main floor of the Pump Station: 300 psf live load
 - b. Intermediate floor of the Pump Station: 150 psf live load
 - c. EQ Basin: Resist 500 year flood event, equivalent of 7.0' of water over the hatch.
- D. Access hatches shall not exceed an allowable fiber stress of 16,000 psi. Live load deflection shall be limited to L/240 of the span, but not more than 1/4-inch.
- E. All access hatches shall be fabricated from 1/4" plate, minimum and shall be stiffened as required to maintain allowable stress and deflection requirements specified herein. Stiffeners shall consist of angles or bars welded to the bottom of the plate.
- F. Hinges, where indicated on the Drawings, shall be insulated, heavy-duty, cadmium plated bronze with stainless steel pins and fasteners.
- G. All access hatches as indicated on the Drawings shall be provided with recessed handles. Handle material shall be as shown on the Contract Drawings.
- H. Air-tight and water-tight access hatches shall be provided with a 1/8 inch thick neoprene gasket between the checkered plate and the support frame. Gasket material shall be bonded to the support frame and access hatches shall be bolted to the structural support frame with countersunk stainless steel flathead screws.

2.05 ACCESS DOORS

- A. General
 - 1. Door opening sizes, number and direction of swing of door leaves, and locations shall be as shown on the Drawings. The Drawings shall indicate the clear opening dimensions.
 - 2. All doors shall be aluminum unless otherwise noted.
 - 3. All hatches shall have double leaf doors.
 - 4. Doors shall be designed for flush mounting and for easy opening from both inside and outside.
 - 5. All doors shall be provided with an automatic hold-open arm with release handle.

6. Double leaf doors shall be provided with safety bars to go across the open sides of the door, when in the open position. Brackets shall be provided on the underside of the doors to hold the safety bars when not in use.
7. All hardware, including but not limited to, all parts of the latch and lifting mechanism assemblies, hold open arms and guides, brackets, hinges, springs, pins, and fasteners shall be stainless steel. Hatches shall have removable handles with protective device to prevent the debris from impacting the opening mechanism. Exterior hatches shall have a hasp.
8. All doors shall be watertight with a continuous gasket. All single door applications shall include a continuous EPDM odor reduction gasket.
9. Door frames shall be extruded and equipped with a 1-1/2 inch minimum drain pipe located by the manufacturer. The drain pipe shall be provided by the Contractor and shall extend to the nearest point of discharge acceptable to the Engineer.

B. Floor, Wet Well and Dry Pit Access Doors

1. Door leaves shall be 1/4 inch, minimum, diamond pattern plate with an approved raised pattern, non-skid surface. Plate shall be stiffened as required to maintain allowable stress and deflection requirements. Stiffeners shall consist of angles or bars welded to the bottom of plate.
2. Doors shall be designed for a 300 psf live load minimum, unless noted otherwise.
3. Doors shall be designed for flush mounting and for easy opening from both inside and outside.
4. All doors shall have an enclosed compression spring assist and open to 90 degrees.
5. Exterior doors shall be Type "J-AL" or "JD-AL", by Bilco Company, Type "W1S" or "W2S" by Halliday Products Inc., Type "TPS" or "TPD", by U.S.F. Fabrication Inc., Type "THG" or "THG-D", by Thompson Fabricating LLC.
6. Interior doors shall be Type "K" or "KD", by Bilco Company, Type "S1S" or "S2S" by Halliday Products Inc., Type "APS300" or "APD300", by U.S.F. Fabrication Inc., Type "TH" or "TH-D", by Thompson Fabricating LLC.
7. Doors rated for H-20 traffic loading shall be "JAL-HD" or "JDAL-HD" by the Bilco Company, Type "H1C" or "H2C" by Halliday Products, Inc., or Type "THS" or "THD" by U.S.F. Fabrication Inc.

2.06 FALL THROUGH PREVENTION SYSTEM

- A. All access hatches and access doors covering openings measuring 12 inches or more in its least dimension through which persons may fall shall be equipped with a fall through prevention system, except where noted on the Contract Drawings. Access hatches and access doors shall be provided with a permanent installed fall through prevention grate system that provides continuous safety assurance in both its closed and open positions.

The grate system shall be made with 6061-T6 aluminum or FRP and be designed for a 300 psf minimum liveload, unless noted otherwise.

PART 3 -- EXECUTION

3.01 FABRICATION

- A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.
- B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.
- C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.
- D. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.
- E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.
- F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to Section 05050, Metal Fastening. All fastenings shall be concealed where practicable.

3.02 INSTALLATION

- A. Assembly and installation of fabricated system components shall be performed in strict accordance with manufacturer's recommendations.
- B. All gratings, access hatches, and access doors shall be erected square, plumb and true, accurately fitted, adequately anchored in place, and set at proper elevations and positions. Embedded support frames shall be set level and square.
- C. Grating shall not be field cut or modified unless approved by Engineer.
- D. Grating shall not be used for equipment support or anchorage.

- END OF SECTION -

SECTION 051200 - STRUCTURAL STEEL FRAMING

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. Structural steel.
 2. Grout.
- B. Related Requirements:
 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 2. Section 055000 "Metal Fabrications" for steel shelf angles not attached to structural- framing, miscellaneous steel fabrications and other steel items not defined as structural steel.
 3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Include embedment Drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, shop-painting applicators, and testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shear stud connectors.
 5. Shop primers.
 6. Non-shrink grout.
- F. Source quality-control reports.
- G. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- E. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 360.
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 3125/F 3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/F 3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers; all with plain finish.
 1. Direct-Tension Indicators: ASTM F 959/F 959M, Type 325-1, compressible-washer type with plain finish.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F 3125/F 3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A 563,

Grade DH (ASTM A 563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959/F 959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.3 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.
- C. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- D. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning." Or SSPC-SP 3, "Power Tool Cleaning."
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

- D. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintel, and shelf angles attached to structural framing and located in exterior walls or as noted on the construction documents.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: As Indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous framing and supports.
 - 2. Metal bollards.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Fasteners.
 - 2. Shop primers.
 - 3. Shrinkage-resisting grout.
 - 4. Metal bollards.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated Design Submittals: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

- C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- E. Rolled-Stainless Steel Floor Plate: ASTM A793.
- F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- H. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- I. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- J. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
- B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 METAL BOLLARDS

- A. Fabricate metal bollards from steel shapes, as indicated.
- B. Fabricate sleeves for bollard anchorage from steel or stainless-steel pipe or tubing with 1/4-inch- thick, steel or stainless-steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- C. Prime steel bollards with primer specified in Section 099600 "High-Performance Coatings."

2.8 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Galvanize and prime loose steel lintels located in exterior walls.
- C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.9 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.
- C. Anchor shelf angles securely to existing construction with expansion anchors anchor bolts.
- D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
1. Embed anchor bolts at least 4 inches in concrete.
- C. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- D. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

- E. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055116 – ALUMINUM FLOOR PLATES AND FRAMES

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 WORK

- A. The Contractor, under this section, shall furnish and properly install all aluminum checkered cover plates and frames as shown on the Drawings or as directed.
- B. It is the intent of this Contract that the final installation shall be complete in all respects and the Contractor will be responsible for all minor details, whether or not shown on the Drawings or specifically included in these Specifications.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 ALUMINUM CHECKERED COVER PLATES

- A. Aluminum checkered cover plates shall be raised pattern and 1/4-in. thick, unless otherwise indicated.
- B. Material for aluminum cover plates shall be aluminum alloy 6061-T6 in accordance with the latest ASTM Specification B221.
- C. Cover plates shall be furnished with a standard mill finish.
- D. The cover plates shall be designed for three times a normal load of 150 lbs./sq. ft. Maximum deflection under a 150 lbs./sq. ft. load shall not exceed 1/4-in. or 1/180th of the span, whichever is least. Stiffeners shall be supplied when necessary.
- E. Individual plates shall not exceed a total weight of 125 lbs., unless otherwise directed by the Engineer.

- F. Plates not requiring hinges shall be bolted in place and shall be made airtight with a neoprene gasket.
- G. Cover plate frames shall conform to details on the Drawings. Frames shall be shop welded with full strength welds and all exposed welds ground flush.
- H. In a case where frames would be large and bending could occur, field jointing shall be allowed using mechanical joints. All frames shall be adequately braced and strapped to wood blocking during shipment and installation to prevent damage.
- I. Required hinges shall be stainless steel butt hinges or piano hinges.
- J. Required lifting handle shall be aluminum alloy 6061-T6.
- K. All required fasteners shall be Type 304 stainless steel.

2.2 PAINTING

- A. Direct contact between aluminum components and any dissimilar metals shall be prevented by painting the dissimilar metal with primer or asphalt paint.
- B. Direct contact between aluminum components and concrete or mortar shall be prevented by painting aluminum contact surfaces with bituminous paint or water white methacrylate lacquer.
- C. Mechanical finishing shall be in accordance with NAAMM Finishes Manual. Electro-chemical, chemical, organic finishes on metal shall conform to industry standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The cover plates shall be installed in the frames set in the concrete surface to support the cover plates. The cover plates shall be set flush with the surrounding surface.
- B. No plate shall rock when any part of it is stepped on.

END OF SECTION 055116

SECTION 055119 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Industrial Class stairs with steel-grating treads.
2. Steel railings and guards attached to metal stairs.
3. Steel handrails attached to walls adjacent to metal stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another. Stairs in direct contact with sanitary effluent shall be fabricated from aluminum and utilize stainless steel fasteners/anchors.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Shop primer products.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

- C. Delegated Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings, and guards, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 125 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to $L/360$.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Aluminum Bars for Grating Treads: ASTM B221 extruded aluminum, alloys as follows:
 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 2. 6061-T1, for grating crossbars.
 3. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- F. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed).
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 2. Provide galvanized finish for exterior installations and where indicated.
- G. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- H. Provide galvanized finish for exterior installations and where indicated.

2.3 FASTENERS

- A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I-A, and compatible with topcoat.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.

2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
 1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 2. Locate joints where least conspicuous.
 3. Fabricate joints that are exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 1. Fabricate stringers of steel plates or channels.

- a. Stringer Size: As required to comply with "Performance Requirements" Article.
 - b. Provide closures for exposed ends of channel stringers.
 - c. Finish: Shop primed Painted.
 - 2. Construct platforms and tread supports of steel plate or channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
 - a. Provide closures for exposed ends of channel framing.
 - b. Finish: Shop primed Painted.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
 - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
 - 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
- 1. Fabricate treads and platforms from welded steel or pressure-locked steel grating with and crossbars at 4 inches o.c.
 - 2. Fabricate treads and platforms from welded steel or pressure-locked steel grating with openings in gratings no more than 1 inch in least dimension.
 - a. Surface: Serrated.
 - b. Finish: Painted.
 - 3. Fabricate grating treads with cast-abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections.
 - a. Secure treads to stringers with bolts.
 - 4. Fabricate grating platforms with nosing matching that on grating treads.
 - a. Secure grating to platform framing by welding.
- D. Risers: Open.
- E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
- 1. Material and Finish: Steel plate to match finish of other steel items.
 - 2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

- B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: 1-1/2-inch- square top and bottom rails and 1-1/2-inch- square posts.
 2. Mesh Infill: Woven -wire mesh into 1-by-1/2-by-1/8-inch steel channel frames. Orient wire mesh with.
 3. Intermediate Rails Infill: 1-1/2-inch- square intermediate rails spaced less than 21 inches clear.
- C. Welded Connections: Fabricate railings and guards with welded connections.
1. Fabricate connections that are exposed to weather in a manner that excludes water.
 - a. Provide weep holes where water may accumulate internally.
 2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 3. Weld all around at connections, including at fittings.
 4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 5. Obtain fusion without undercut or overlap.
 6. Remove flux immediately.
 7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #3 - Partially dressed weld with spatter removed as shown in NAAMM AMP 521.
- D. Form changes in direction of railings and guards as follows:
1. As detailed.
- E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.
1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- F. Close exposed ends of railing and guard members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- H. Connect posts to stair framing by direct welding unless otherwise indicated.

- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - 1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 3. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 - 4. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
 - 1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs:
 - a. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces.
 - a. Clean bottom surface of baseplates.
 - b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
 - c. After stairs have been positioned and aligned, tighten anchor bolts.
 - d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - 3. Comply with requirements for welding in "Fabrication, General" Article.

3.2 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by welding or bolting to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055119

SECTION 055200 - ALUMINUM HANDRAILS

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 WORK

- A. The Contractor, under this section, shall provide and install all aluminum handrailing as shown on the Drawings or as directed. Unless otherwise shown on the Drawings, all handrailings shall be aluminum.
- B. It is the intent of this Contract that the final installation shall be complete in all respects, and the Contractor will be responsible for all minor details, whether or not shown on the Drawings or specifically included in these Specifications.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Submit manufacturer's certificates and calculations indicating the compliance of all OSHA requirements and loadings.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.
- D. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing number, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting members at intersections.

PART 2 - PRODUCTS

2.1 HANDRAILING

- A. Aluminum pipe rails and posts shall be 1-1/2 in. nominal diameter pipe made of alloy 6063-T6. Aluminum handrail shall be anodized. The color shall be selected by the Engineer. Railing components, fastenings, and complete structure shall meet all requirements of OSHA. All rails and posts shall be a minimum of Schedule 40 and 80 respectively.
- B. All handrails, unless otherwise shown on the Drawings, shall be as follows:
 - 1. All bottom mounted rails should be 3 ft.-6 in. high, measured from the floor to the top of the rail, with intermediate rail on the posts. Posts shall be placed at a maximum of 6 ft. and at each change in direction. Posts shall be attached to the top of the walkway or curb as shown on the Drawings. The mounting plate shall be made of alloy 6061-T6.
 - 2. Bends, where called for, shall be shop formed and present pleasing appearance.
 - 3. The top surface of the top railing shall be smooth and shall not be interrupted by a projecting fitting.
 - 4. All openings in the railing shall be spanned with a 1/4 in. type 304 stainless steel chain with snap hook at one end and fixed to post at other end. Hooks and eyes shall be stainless steel.
 - 5. Toe plates shall conform to OSHA Standards. Toe plates shall not be pop-riveted to posts.
 - 6. Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 PAINTING

- A. Direct contact between aluminum components and any dissimilar metals shall be prevented by painting the dissimilar metal with primer or asphalt paint.
- B. Direct contact between aluminum components and concrete or mortar shall be prevented by painting exposed aluminum surfaces with bituminous paint or water white methacrylate lacquer.
- C. Finishing shall be in accordance with Aluminum Association M10C22 A41 Clear Anodized. The handrail system shall be plastic wrapped and not removed until after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All work performed shall be in accordance with the manufacturer's recommendation for installation.
- B. All work shall be free from defects of any type which affect durability, strength, or appearance.
- C. Support brackets shall be securely anchored into the wall by anchor bolts or wedge type expansion bolts.
- D. Posts shall be set on mounting plates attached to the floor or curb by stainless steel concrete anchor bolts in concrete.
- E. All erection shall meet OSHA requirements and the manufacturer's recommendations.
- F. Upon completion of railing installation all work shall be cleaned to make it acceptable for final inspection.
- G. For protection from temperature induced stresses an expansion joint and gap shall be provided in every top rail on a maximum of 24 feet. Top rails only shall have expansion joints between the fixed points. Use 1/8 inch gap between bottom rail and each fitting.

END OF SECTION 055200

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Framing with dimension lumber.
 - 2. Rooftop equipment bases and support curbs.
 - 3. Wood blocking and nailers.
 - 4. Wood furring and grounds.
 - 5. Wood sleepers.
 - 6. Plywood backing panels.

- B. Related Requirements:

- 1. Section 061735, "Engineered Wood Framing."
 - 2. Section 061753, "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
1. Fire-retardant-treated wood.
 2. Power-driven fasteners.
 3. Post-installed anchors.
 4. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, 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.
 3. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all rough carpentry unless otherwise indicated.

2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
 - 1. Application: Interior partitions not indicated as load bearing.
 - 2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine or mixed southern pine; SPIB.
 - c. Spruce-pine-fir; NLGA.
 - d. Eastern softwoods; NeLMA.
- B. Load-Bearing Partitions: No. 2 grade.

1. Application: Exterior walls.
 2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Spruce-pine-fir; NLGA.
 - e. Douglas fir-larch (north); NLGA.
 - f. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Joists, Rafters, and Other Framing Not Listed Above: Select Structural No. 1 No. 2 grade.
1. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Southern pine or mixed southern pine; SPIB.
 - e. Spruce-pine-fir; NLGA.
 - f. Douglas fir-larch (north); NLGA.
 - g. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

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.
 4. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch 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. Provide fasteners of Type 304 stainless steel complying with ASTM A240/A240M or ASTM A666.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cleveland Steel Specialty Co.
 - 2. Simpson Strong-Tie Co., Inc.
 - 3. USP Structural Connectors.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. 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. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316
- D. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.050 inch.

- E. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- F. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
 - 1. Bolt Diameter: 5/8 inch.
 - 2. Width: 2-1/2 inches.
 - 3. Body Thickness: 0.108 inch.
 - 4. Base Reinforcement Thickness: 0.108 inch.

2.8 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt 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.

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, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install shear wall panels to comply with manufacturer's written instructions.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level and at ceiling, with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. 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. Table R602.3(1), "Fastener Schedule for Structural Members."
 - 3. ICC-ES evaluation report for fastener.
- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without

splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with indicated fastener patterns where applicable.
 - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive FRP-laminated Plywood or: Install 2-by-4-inch nominal- size furring horizontally at 24 inches 600 mm o.c.
- C. Purlins to Receive Prefinished Metal Wall, Liner or Roof Panels: Install 2-by-4-inch nominal- size furring horizontally at 24 inches 600 mm o.c.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches 400 mm o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches 400 mm o.c. unless otherwise indicated.

3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
 - C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 6-inch nominal depth for openings up to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.
 - D. Provide diagonal bracing in walls, at locations indicated, at 45-degree angle, full-story height unless otherwise indicated. Use 1-by-4-inch nominal- size boards, let-in flush with faces of studs.

3.5 INSTALLATION OF FLOOR JOIST FRAMING

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
 1. Where supported on wood members, by using metal framing anchors.
 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- C. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.
- D. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- E. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.
- F. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
 1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- size lumber, double-crossed and nailed at both ends to joists.

2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 SPECIAL FRAMING

- A. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 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 enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061735 - ENGINEERED WOOD FRAMING

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. Wood I-joists framing.
2. Bridging, bracing, and anchorage.
3. Framing for openings.
4. Laminated Veneer Lumber (LVL)
5. Laminated Strand Lumber (LSL).
6. Wood blocking and nailers.

- B. Related Requirements:

1. Section 061000, "Rough Carpentry."
2. Section 061753, "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.3 CODE APPROVALS

- A. These products shall be designed and manufactured to the standards set forth in the ICC Evaluation Service, Inc. report ESR-1153.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.
- B. Shop drawing: Submit shop drawing that indicates the location and size of each plate and item of the assembly, the structural item the plate will bear on, location of fasteners, and the location of any ancillary items.
 1. Indicate sizes and spacing of members, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between members.
 2. Include details of cuts, connections, splices, and other pertinent data.
 3. Indicate type, size, and metal fanning connectors.
- C. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

D. 1.06 QUALITY ASSURANCE

1. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum six years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.
- B. Protect products from damage due to weather and breakage.
- C. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks. D. Handle individual joists in the upright position.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Georgia-Pacific Corporation.
- B. LP Building Products.
- C. Weyerhaeuser.
- D. Boise Cascade.

2.2 MATERIALS

- A. I-Joist: Flange members, web members and adhesives shall conform to the provisions of the ICC ES ESR-1153
- B. Microlam LVL: Materials shall comply with ICC ES ESR-1387
- C. Laminated Strand Lumber (LSL): Materials shall comply with ICC ES ESR-1387.
- D. Adhesives: Adhesives shall be of the waterproof type conforming to the requirements of ASTM D-2559.

2.3 WOOD TREATMENT

- A. Factory-Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that supports and openings are ready to receive joists.

- B. Verify that field measurements are as indicated on shop drawings.

3.2 PREPARATION

- A. Coordinate placement of bearing and support items.

3.3 ERECTION

- A. Install joists in accordance with manufacturer's instructions.
- B. Set structural members level and plumb, in correct position.
- C. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.
- D. Install permanent bridging and bracing as required.
- E. Install headers and supports to frame openings as required.
- F. Coordinate installation of sheathing/decking with work of this section.

END OF SECTION 061000

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

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. Wood roof trusses.
 - 2. Metal framing anchors and accessories. Only metal framing anchors and accessories to attaching the truss to the building walls.
- B. Related Requirements:
 - 1. Section 061000, "Rough Carpentry."
 - 2. Section 061735, "Engineered Wood Framing."

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Truss Assembly: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification from treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.

- B. Shop Drawings: Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of individual wood truss members.
 - 3. Indicate locations, sizes, and materials for permanent bracing required by the Truss Engineer.
 - 4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 5. Show splice details and bearing details.
 - 6. Provide manufacture's name, product number, number of pieces, and the attachment requirements for all metal framing anchors and accessories between the wood trusses and the building walls. Identify the locate where the hold downs are attached to the truss assembly.
- C. Delegated-Design Submittal: Submit shop drawing and a design calculation package for metal-plate-connected wood truss assembly that comply with performance requirements, design criteria, and the approved building code. Include analysis data that is signed and sealed by the qualified professional engineer responsible for their preparation. The professional engineer shall be license in the state that the project is located in.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer and fabricator.
- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Evaluation Reports: For the following, from ICC-ES:
 - 1. Fire-retardant-treated wood.
 - 2. Metal-plate connectors.
 - 3. Metal truss accessories.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending and/or distortion.
 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
1. Include wood truss bracing.
- B. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- C. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Provide dressed lumber, S4S.
 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 FIRE-RETARDANT-TREATED WOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use for interior locations where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing and framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed trusses and bracing indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all trusses unless otherwise indicated.

2.4 METAL CONNECTOR PLATES

- 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. Alpine Engineered Products, Inc.; a division of ITW Building Components Group, Inc.
 - 2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
 - 3. MiTek Industries, Inc.
 - 4. Truswal Systems Corporation.
- B. Fabricate connector plates to comply with TPI 1.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316, and not less than 0.035 inch thick.

2.5 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners of Type 316 stainless steel complying with ASTM A240/A240M or ASTM A666.
- B. Nails, Brads, and Staples: ASTM F1667.

2.6 METAL FRAMING ANCHORS AND ACCESSORIES

- 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. Cleveland Steel Specialty Co.
 - 2. Phoenix Metal Products, Inc.
 - 3. Simpson Strong-Tie Co., Inc.
 - 4. USP Structural Connectors.
- B. Allowable design loads, as published by manufacturer, shall comply with or exceed those of basis-of-design products of products of manufacturers listed. 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. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.
- D. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
- E. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- F. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.
 - 1. Angle clip is 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.
 - 2. Angle clip is 3 by 3 by 0.239 by 10-1/2 inches with extended leg 10-1/2 inches long. Connector has painted finish.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.8 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.9 SOURCE QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses 24 inches o.c.; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not comply with requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND 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 wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 061753

SECTION 068000.02 - FRP WEIRS

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 WORK

- A. This section includes the fabrication and installation of FRP troughs and weirs, along with all guides, support brackets, fasteners, anchors, and other incidental work.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Shop Drawings submittals shall include – but are not limited to – the following:
 - 1. Manufacturer's catalog information, descriptive literature, specifications and identification of materials of construction, including resins and glass fiber content and layout for FRP constructions.
 - 2. Detailed drawings that show equipment fabrication dimensional layouts, bill of materials, bolt and anchor locations, method of attachment including number, locations and size of fasteners, and shall be based on field measurements by the Contractor to ensure proper installation.
- B. Quality Control Submittal shall include the following:
 - 1. Manufacturer's Certificate of Compliance.
 - 2. Special shipping, storage and protection and handling instructions.
 - 3. Manufacturer's written/printed installation instructions.
 - 4. A list of installations of comparable size in operation for at least three years.
 - 5. Certified test reports of the physical and mechanical properties of the product

1.5 WARRANTY

- A. Manufacturer shall warrant the weirs to be free of defects in materials and workmanship for a period of one year after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Troughs, weir plates and washers shall be constructed of 1/4 in. fiberglass reinforced polyester (FRP) resin with a thermoplastic surfacing mat to prevent ultraviolet deterioration. All fiberglass troughs and weir plates shall be of the same color as selected by the Owner. There shall be included all necessary butt plates, cover plates, anchors, nuts, washers, etc., of the material as shown or required for a complete installation.
- B. Physical Properties
1. All laminates shall meet the following minimum physical properties:

ASTM			
		Test	Minimum
		<u>Method</u>	<u>Properties</u>
a.	Tensile Strength (103 psi)	D 638	12.0
b.	Flexural Strength (103 psi)	D 790	19.0
c.	Flexural Modules (103 psi)	D 790	900
d.	Barcol Hardness	D 2583	35 min.
e.	Izod Notched Impact (FT-lbs.)	D 256	13
f.	Water Absorption (24 hrs.)	D 570	2% max.
g.	Laminate Thickness (1/4 inch)		

2.2 FABRICATION

- A. Weir shall be fabricated to dimensions as shown on the Drawings, with modifications based on field measurements. Weir to be of the V-notch type, as shown on the Drawings.
- B. Unless otherwise specified, the weir and its supports shall be fabricated to provide minor adjustments vertically.
- C. All weir supports shall be of the same material as the weir or stainless steel. All fasteners and anchors shall be stainless steel.

- D. All bolt holes and cut edges shall receive two coats of a resin compatible to the original resin. Such coatings shall prevent premature fraying.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Weirs shall be installed as shown on the Drawings.
- B. All weirs shall be leveled. Edges on straight edge weir plates shall be leveled within 1/32" in length of individual weir plates.
- C. Contractor shall provide supports as recommended by the manufacturer to prevent uplift.

END OF SECTION 068000.02

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.

- B. Related Requirements:

1. Section 238316 "Radiant Heat Hydronic Piping" for foam-plastic board sheathing installed under slab.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

- B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
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. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
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. CertainTeed Corporation;
 - b. Johns Manville; a Berkshire Hathaway Company;
 - c. Knauf Insulation;
 - d. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type IA (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 ACCESSORIES

- A. 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 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. 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.

3.3 INSTALLATION OF SLAB INSULATION

- A. 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 in from exterior walls.

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 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 C1320.
- 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.
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072500 - WEATHER BARRIERS

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. Flexible flashing.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show details of building at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For and, from ICC-ES.

PART 2 - PRODUCTS

2.1 FLEXIBLE FLASHING

- A. Butyl Rubber 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.
 - 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. GCP Applied Technologies Inc.
 - b. Protecto Wrap Company.
 - c. Raven Industries, Inc.
- B. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt 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.

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. Advanced Building Products Inc.
 - b. Fortifiber Building Systems Group.
 - c. GCP Applied Technologies Inc.
 - d. MFM Building Products Corp.
 - e. Polyguard Products, Inc.
 - f. TYPAR.
- C. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.
- D. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

PART 3 - EXECUTION

3.1 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 4. Lap water-resistive barrier over flashing at heads of openings.
 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 072600 - VAPOR RETARDERS

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. Polyethylene vapor retarders.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6-mil- thick sheet, with maximum permeance rating of 0.1 perm.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.

- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 074113.13 - STANDING-SEAM METAL ROOF PANELS

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. Formed metal roof panels.

- B. Related Sections:

- 1. Section 074293 "Soffit Panels" for manufactured metal panels used in horizontal soffit applications.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for gutters, downspouts and fasciae and flashings that are not part of sheet metal roofing.
 - 3. Section 079200 "Joint Sealants" for field-applied sealants adjoining sheet metal roofing and not otherwise specified in this Section.

1.3 COORDINATION

- A. Coordinate sheet metal roofing layout and seams with sizes and locations of roof curbs, equipment supports, equipment provided, and roof penetrations.
- B. Coordinate sheet metal roofing installation with rain drainage work, flashing, trim, and construction of roofing substrate, parapets, walls, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

5. Review structural loading limitations of purlins and trusses during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

- A. Coordinate sizes and locations of roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for low-slope roof products.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 1. Wind Loads: As indicated on Drawings.
 2. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646[or ASTM E331] at the following test-pressure difference:
 1. Test-Pressure Difference: 2.86 lbf/sq. ft.

- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 60.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. 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, ambient; 180 deg F, material surfaces.

2.2 EXPOSED-FASTENER, LAP-SEAM, METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Tapered-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced or flat pan between major ribs.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AEP Span; A BlueScope Steel Company.
 - b. Architectural Metal Systems.
 - c. Berridge Manufacturing Company.
 - d. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
 - e. CENTRIA Architectural Systems.
 - f. Dimensional Metals Inc.
 - g. Fabral.
 - h. Firestone Metal Products, LLC.
 - i. MBCI; a division of NCI Group, Inc.
 - j. Morin - A Kingspan Group Company.
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.022 inch (0.56 mm).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.

3. Major-Rib Spacing: 8 inches (203 mm) to 12 inches (304 mm) o.c.
 4. Panel Coverage: 36 inches (914 mm).
 5. Panel Height: 1.0 inches (25 mm) to 1.5 inches (38 mm).
- C. Vee-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AEP Span; A BlueScope Steel Company.
 - b. Alcoa Architectural Products (USA).
 - c. Berridge Manufacturing Company.
 - d. CENTRIA Architectural Systems.
 - e. Dimensional Metals Inc.
 - f. Fabral.
 - g. MBCI; a division of NCI Group, Inc.
 - h. Morin - A Kingspan Group Company.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.022 inch (0.56 mm).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 3. Rib Spacing: 7.2 inches (183 mm) to 12 inches (305 mm) o.c.
 4. Panel Coverage: 32 inches (813 mm) to 40 inches (1016 mm).
 5. Panel Height: 1.25 inches (32 mm) to 1.75 inches (44 mm).

2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch (25-mm) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
- B. Fasteners:
 - 1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Formed Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 3. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 4. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 5. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 6. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 7. Flash and seal panels with weather closures at perimeter of all openings.
 - 8. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.

- b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install flashing and trim as metal panel work proceeds.
 - 2. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 - 3. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/8 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.13

SECTION 074213.13 - FORMED METAL WALL PANELS

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. Concealed-fastener, lap-seam metal wall panels.

- B. Related Sections:

- 1. Section 074113.13 "Standing-Seam Metal Roof Panels" for solid metal plate wall panels.
 - 2. Section 074293 "Soffit Panels" for manufactured metal panels used in horizontal soffit applications.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special details, penetrations, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel systems during and after installation.
 - 8. Review procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
 - 1. Include Samples of trim and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.

- 2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Avitru. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. 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, ambient; 180 deg F, material surfaces.

2.3 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AEP Span; A BlueScope Steel Company.
 - b. Alcoa Architectural Products (USA).
 - c. Berridge Manufacturing Company.
 - d. CENTRIA Architectural Systems.
 - e. Dimensional Metals, Inc.
 - f. Fabral.
 - g. MBCI.
 - h. Morin - A Kingspan Group Company.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 0.022 inch.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
3. Panel Coverage: 12 inches.
4. Panel Height: 1.5 inches.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

2.5 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Flash and seal panels with weather closures at perimeter of all openings.
- D. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Metal Liner Panels: Install panels on interior side of girts with flush appearance on the inside.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips,

and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 074293 - SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Metal soffit panels.

- B. Related Sections:

- 1. Section 074113.13 "Standing-Seam Metal Roof Panels" for lap-seam metal roof panels.
 - 2. Section 074213.13 "Formed Metal Wall Panels" for lap-seam metal wall panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Meet with Owner, Architect, Owner's insurer if applicable, metal soffit panel Installer, metal soffit panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal soffit panels, including installers of roof accessories, metal roofing, and metal wall panels.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal soffit panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special details, penetrations, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal soffit panel systems during and after installation.
 - 8. Review procedures for repair of metal soffit panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

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

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft..
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. 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, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

- B. V-Groove-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with a V-groove joint between panels.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATAS International, Inc.
 - b. Berridge Manufacturing Company.
 - c. Dimensional Metals, Inc.
 - d. Fabral.
 - e. McElroy Metal, Inc.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 0.022 inch.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 3. Panel Coverage: 12 inches.
 4. Panel Height: 0.375 inch.
 5. Perforations: 6.46 square inches of net free area per linear foot of soffit panel.

2.3 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

2.4 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports.

3.3 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 6. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems.

Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
 - 2. Substrate board.
 - 3. Roof insulation.
- B. Section includes installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."
- C. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
 - 3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
 - 4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 - 5. Section 077100 "Roof Specialties" for roof edge flashings.
 - 6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.
- B. Shop Drawings: Include roof plans, sections details and attachments to other work, include the following:
 1. Layout and thickness of installation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation, thickness, and slopes.
 5. Roof plan showing orientation of precast planks, orientation of roof membrane, fastening spacings and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field –of-roof locations.
- C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- C. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is listed in SPRI's Directory of Roof Assemblies for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, substrate board, and other components of roofing system.
 - 2. Warranty Period: 15 years from Date of Substantial Completion.

- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, substrate boards, and, for the following warranty period:

1. Warranty Period: Two years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.
1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures per ASME 7:
1. Zone 1 (Roof Area Field): -29.9 lbf/sq. ft.>.
 2. Zone 2 (Roof Area Perimeter): -34.4 lbf/sq. ft.>.
 - a. Location: From roof edge to three feet inside roof edge.
 3. Zone 3 (Roof Area Corners): -34.4 lbf/sq. ft.>.
 - a. Location: three feet in each direction from building corner.
- D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
1. Wind Uplift Load Capacity: 60 psf.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D4637/D4637M, Type II, scrim or fabric internally reinforced, EPDM sheet with factory-applied seam tape.

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. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. GenFlex Roofing Systems.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Mule-Hide Products Co., Inc.
 - f. Versico Roofing Systems.
2. Thickness: 60 mils, nominal.
3. Exposed Face Color: White on black.
4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.
 1. Size: Not less than 4-inch diameter.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film.
- G. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
 1. Provide white flashing accessories for white EPDM membrane roofing.

2.4 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.
 - 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. National Gypsum Company.
 - b. USG Corporation.
 - 2. Thickness: 1/2 inch.
 - 3. Surface Finish: Unprimed.
- B. Substrate Board: ASTM C728, perlite board; seal coated.
 - 1. Thickness: 3/4 inch.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.45-lb/cu. ft. minimum density, 25-psi minimum compressive strength square edged.
 - 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. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - 2. Thermal Resistance: R-value of 5.0 per inch.
 - 3. Size: 48 by 48 inches.
 - 4. Thickness:
 - a. Base Layer: 1-1/2 inches.
 - b. Upper Layer: 1-1/2 inches.
- C. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15-lb/cu. ft. minimum density, with factory-applied facings, as follows:

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. ACH Foam Technologies, Inc.
 - b. AFM Corporation.
 - c. Cellofoam North America, Inc.
 - d. Insulfoam; Carlisle Construction Materials Company.
2. Size: 48 by 48 inches.
3. Thickness: 1-1/2 inches.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer when tested according to ASTM F2170.
 - a. Test Frequency: One test probe per each 1000 sq. ft., or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.

6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
8. Verify that minimum curing period recommended by roof system manufacturer for lightweight insulating concrete roof decks has passed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under

3.4 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Concrete Decks:
 - 1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. Fill gaps exceeding 1/4 inch with insulation.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - f. Loosely lay base layer of insulation units over substrate.
 - g. Adhere base layer of insulation to concrete roof deck according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft., and allow primer to dry.
 - 2) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
 - 3) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 4) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 - 2. Install upper layers of insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. Fill gaps exceeding 1/4 inch with insulation.
 - f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - g. Loosely lay each layer of insulation units over substrate.

- h. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.
 - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 - 2. Apply lap sealant and seal exposed edges of roofing terminations.
 - 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
 - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 - 2. Apply lap sealant and seal exposed edges of roofing terminations.

- J. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- K. Adhere protection sheet over roof membrane at locations indicated.

3.6 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Copings.
 - 2. Roof-edge drainage systems.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 074113.13 "Standing-Seam Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
 - 3. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for membrane roofing.
 - 4. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 5. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- 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.
 - 2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 4. Detail termination points and assemblies, including fixed points.
 - 5. Include details of special conditions.

- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For manufacturer's special warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are SPRI ES-1 tested to specified design pressure.
- B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 074223.16 and 075323.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 074113.13 "Sanding-seam metal roofing panels" or Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" as applicable to the building upon which they are installed.
- B. 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 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. SPRI Wind Design Standard: Manufacture and install copings roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.
- C. 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, ambient; 180 deg F, material surfaces.

2.2 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
 - 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. Architectural Products Company.
 - b. ATAS International, Inc.
 - c. Berridge Manufacturing Company.
 - d. Cheney Flashing Company.
 - e. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - 2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, thickness as required to meet performance requirements.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.

3. Extruded-Aluminum Coping Caps: Extruded aluminum, thickness as required to meet performance requirements.
 - a. Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
4. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
 - b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Architectural Products Company.
 2. ATAS International, Inc.
 3. Berger Building Products, Inc.
 4. Cheney Flashing Company.
 5. Merchant and Evans.
 6. Metal-Era, Inc.
 7. OMG, Inc.
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch 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: 0.032 inch thick.
 2. Gutter Profile: Ogee according to SMACNA's "Architectural Sheet Metal Manual."
 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 4. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
- C. Downspouts: Corrugated rectangular complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 1. Formed Aluminum: 0.032 inch thick.
- D. Aluminum Finish: Two-coat fluoropolymer.
 1. Color: As selected by Architect from manufacturer's full range.

2.4 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
- D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.5 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.
 - 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Galvanized-Steel Sheet Finishes:
 - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

E. 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 polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

F. Aluminum Extrusion 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 2604. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. 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, separators, underlayments, 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 with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F, 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 for nails and not less than 3/4 inch 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.

3.3 INSTALLATION OF COPINGS

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers.
 2. Interlock face-leg drip edge into continuous cleat anchored to substrate at 24-inch centers. Anchor back leg of coping with screw fasteners and elastomeric washers at 24-inch centers.

3.4 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

- A. 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 24 inches 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 apart. Install expansion-joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches 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.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Mildew-resistant joint sealants.
 - 5. Butyl joint sealants.
 - 6. Latex joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 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 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 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

- B. 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.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adfast.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d. Pecora Corporation.
 - e. Sika Corporation; Joint Sealants.
 - f. The Dow Chemical Company.
 - g. Tremco Incorporated.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane 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. BASF Corporation.
 - b. Bostik, Inc.
 - c. ER Systems; an ITW Company.
 - d. Everkem Diversified Products, Inc.
 - e. Pecora Corporation.
 - f. Polymeric Systems, Inc.

- g. Sherwin-Williams Company (The).
- h. Sika Corporation; Joint Sealants.
- i. Tremco Incorporated.

B. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.

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

- a. LymTal International Inc.

2.5 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. Adfast.
- b. GE Construction Sealants; Momentive Performance Materials Inc.
- c. May National Associates, Inc.; a subsidiary of Sika Corporation.
- d. Pecora Corporation.
- e. The Dow Chemical Company.
- f. Tremco Incorporated.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

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

- a. Bostik, Inc.
- b. Pecora Corporation.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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

- a. Everkem Diversified Products, Inc.
- b. Franklin International.
- c. May National Associates, Inc.; a subsidiary of Sika Corporation.
- d. Pecora Corporation.
- e. Sherwin-Williams Company (The).
- f. Tremco Incorporated.

2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adfast.
 - b. Alcot Plastics Ltd.
 - c. BASF Corporation.
 - d. Construction Foam Products; a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. 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 of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of 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.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - 4. Provide flush joint profile at according to Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints in unit masonry.
 - b. Joints between metal panels.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors and louvers.
 - e. Control and expansion joints in ceilings and other overhead surfaces.
 - f. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, 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.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Vertical joints on exposed surfaces of unit masonry.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087111 "Door Hardware (Descriptive Specification)" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

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

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware and access control and security systems.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Product Schedule: For hollow metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Deansteel Manufacturing Company, Inc.
 - 4. Fleming Door Products Ltd.; Assa Abloy Group Company.
 - 5. Gensteel Doors, Inc.
 - 6. LaForce, Inc.
 - 7. Mesker Door Inc.
 - 8. Pioneer Industries.
 - 9. Republic Doors and Frames.
 - 10. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.45 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches.
- c. Face: Metallic-coated steel sheet, minimum thickness of 0.032 inch.
- d. Edge Construction: Model 1, Full Flush.
- e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
- f. Core: Manufacturer's standard.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
- b. Construction: Knocked down.

3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches.
- c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
- d. Edge Construction: Model 1, Full Flush.
- e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
- f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
- g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
- h. Core: Manufacturer's standard.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
- b. Construction: Face welded.

3. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.7 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness 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 welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/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 BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Floor Anchors: 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. Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083323 - OVERHEAD COILING DOORS

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. Insulated service doors.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.

- 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Include description of automatic-closing device and testing and resetting instructions.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

- 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

- 1. Include similar Samples of accessories involving color selection.

- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

- 1. Curtain slats.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E330/E330M or DASMA 108 for garage doors and complying with acceptance criteria of DASMA 108.

3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.3 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 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. Clopay Building Products.
 - b. Cookson Company.
 - c. Cornell.
 - d. McKeon Rolling Steel Door Company, Inc.
 - e. Overhead Door Corporation.
 - f. Raynor.
 - g. Wayne-Dalton Corp.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283 or DASMA 105.
- D. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.
- E. Door Curtain Material: Galvanized steel.
- F. Door Curtain Slats: Curved Flat profile slats of 1-7/8-inch, 2-5/8-inch, or 3-1/4-inch center-to-center height.
 1. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from stainless steel and finished to match door.
- H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- I. Hood: Match curtain material and finish.
 1. Shape: Manufacturer's standard round or square.
 2. Mounting: Face of wall.
- J. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn.

K. Electric Door Operator:

1. Usage Classification: Medium duty, up to 12 or more cycles per hour and up to 50 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Exterior, wet, and humid.
5. Motor Electrical Characteristics:
 - a. Horsepower: 3/4 hp.
 - b. Voltage: 208-120V ac, single phase, 60 Hz.
6. Emergency Manual Operation: Chain Crank type.
7. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: Black.
8. Control Station(s): Exterior mounted with key pad and interior mounted push button.

L. Curtain Accessories: Equip door with weatherseals.

M. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 MATERIALS, GENERAL

- 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.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
 2. Stainless Steel Door Curtain Slats: ASTM A240/A240M or ASTM A666, Type 304; sheet thickness of 0.025 inch; and as required.
 3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
 4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.
 5. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 25 and smoke-developed index of 450, according to ASTM E84 or UL 723.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.
 2. Stainless Steel: 0.025-inch- thick, stainless steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.

2.7 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: Cylinders specified in Section 087100 "Door Hardware" or as standard with manufacturer and keyed to building keying system.
 2. Keys: Three for each cylinder.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each emergency-operated door with lifting handles on each side of door, finished to match door.
- C. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches high.

2.9 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Motors: Reversible-type motor for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
 - 2. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 083613 - SECTIONAL DOORS

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 electrically operated sectional doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Flat door sections.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.

2.3 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amarr Garage Doors.
 - b. Arm-R-Lite.
 - c. C.H.I. Overhead Doors, Inc.
 - d. Clopay Building Products.
 - e. Haas Door.
 - f. Overhead Door Corporation.
 - g. Raynor.
 - h. Rite-Hite Corporation.
 - i. Wayne-Dalton Corp.
 - j. Windsor Door.
- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. (0.406 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E 283 or DASMA 105.
- D. R-Value: 12.0 deg F x h x sq. ft./Btu (2.113 K x sq. m/W).
- E. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 (Z180) zinc coating.

1. Section Thickness: 1-3/4 inches (44 mm).
 2. Exterior-Face, Steel Sheet Thickness: 0.022-inch-(0.56-mm-) nominal coated thickness.
 - a. Surface: Manufacturer's standard, ribbed.
 3. Insulation: Foamed in place.
 4. Interior Facing Material: Zinc-coated (galvanized) steel sheet with a nominal coated thickness of manufacturer's recommended dimension to comply with performance requirements.
- F. Track Configuration: Standard-lift track.
- G. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.
- H. Roller-Tire Material: Case-hardened steel.
- I. Locking Devices: Equip door with slide bolt.
- J. Counterbalance Type: Torsion spring.
- K. Emergency Manual Door Operator: Push up operation.
- L. Electric Door Operator:
1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
 2. Operator Type: Manufacturer's standard jackshaft operator for door requirements.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.4 m) or lower.
 4. Motor Exposure: Interior, clean, and dry. Motor shall be fully enclosed and explosion proof.
 5. Emergency Manual Operation: Chain-hoist type.
 6. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom section.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
 7. Control Station: Interior-side mounted.
- M. Door Finish:
1. Baked-Enamel or Powder-Coat Finish: Color and gloss as selected by Architect from manufacturer's full range.
 2. Finish of Interior Facing Material: Match finish of exterior section face.

2.4 MATERIALS, GENERAL

- 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.

2.5 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
 - 1. Fabricate section faces from single sheets to provide sections not more than 24 inches (610 mm) high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
 - 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch-(1.63-mm-) nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch-(1.63-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- E. Provide reinforcement for hardware attachment.
- F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections and the interior facing material, with no exposed insulation.
- G. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
- H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.6 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
 - 1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 (Z180) zinc coating.
 - 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
 - 3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.
 - a. For Vertical Track: Intermittent, jamb brackets attached to track and attached to wall.
 - b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.7 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch-(2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-(76-mm-) diameter roller tires for 3-inch-(76-mm-) wide track and 2-inch-(51-mm-) diameter roller tires for 2-inch-(51-mm-) wide track.

2.8 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking, located on single-jamb side, operable from inside only.

- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
- C. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- D. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- E. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.10 MANUAL DOOR OPERATORS

- A. General: Equip door with emergency manual door operator by door manufacturer where indicated.

2.11 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
 - 3. Operator to be fully enclosed and explosion proof.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Manufacturer's recommended unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

1. Jackshaft, Center Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.
 2. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 5. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
1. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Where indicated, equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit

switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.12 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches (610 mm) apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway

bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 085113 - ALUMINUM WINDOWS

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 aluminum windows for exterior and interior locations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: For aluminum windows.
 - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of hardware and accessories involving color selection.
- D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 2 years from date of Substantial Completion.
 - b. Glazing Units: Five years from date of Substantial Completion.
 - c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 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: AAMA 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: CW.
 - 2. Minimum Performance Grade: 40.
- C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.
- D. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of

components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.3 ALUMINUM WINDOWS

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

1. All Seasons Window & Door Mfg.; All Seasons Commercial Division, Inc.
2. Boyd Aluminum Manufacturing.
3. Custom Window Company.
4. DeSCo Windows.
5. EFCO Corporation.
6. Fleetwood Windows & Doors.
7. Kawneer North America, an Arconic company.
8. Peerless Products Inc.
9. Quaker Window Products, Inc.
10. Thermal Windows, Inc.
11. TRACO.
12. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.
13. Winco Manufacturing Co.
14. YKK AP America Inc.

- B. Types: Provide the following types in locations indicated on Drawings:

1. Horizontal sliding.
2. Fixed.

- C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/ A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

- D. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, 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 air.
4. Low-E Coating: 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 hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- H. 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.

2.4 ACCESSORIES

- A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 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, outside for sliding sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

- C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 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 D3656/D3656M.

- 1. Mesh Color: Manufacturer's standard.

2.6 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. 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.
- G. Window Assemblies: Provide operating and fixed units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - 1. Angled mullion posts with interior and exterior trim.
 - 2. Angled interior and exterior extension and trim.
 - 3. Exterior head and sill casings and trim.
- H. 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.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 E2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087111 - DOOR HARDWARE (DESCRIPTIVE SPECIFICATION)

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. Mechanical door hardware for the following:
 - a. Swinging doors.

- B. Related Requirements:

- 1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
- 2. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
- 3. Section 083613 "Sectional Doors" for door hardware provided as part of upward acting sectional doors.

1.3 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.4 PREINSTALLATION MEETINGS

- A. Keying Conference: Conduct conference at Project site: Village of Piketon Water Reclamation Facility, 1150 Piketon Road, Piketon, Ohio 45661.
 - 1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
 - 2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.

- d. Requirements for access control.
- e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Fastenings and other installation information.
 - e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - f. Mounting locations for door hardware.
 - g. List of related door devices specified in other Sections for each door and frame.
- C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
- 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 an Architectural Hardware Consultant (AHC).

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys to Owner by registered mail or overnight package service.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Locks: Five years from date of Substantial Completion.

- b. Exit Devices: Two years from date of Substantial Completion.
- c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
 - 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.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 SCHEDULED DOOR HARDWARE

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
 - 1. Door hardware is scheduled in Part 3.

2.4 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 - 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. Allegion plc.
 - b. Baldwin Hardware Corporation.

- c. Bommer Industries, Inc.
- d. Hager Companies.
- e. Lawrence Hardware Inc.
- f. McKinney Products Company; an ASSA ABLOY Group company.
- g. PBB, Inc.
- h. Stanley Commercial Hardware; a division of Stanley Security Solutions.

B. Antifriction-Bearing Hinges:

- 1. Mounting: Full mortise (butts).
- 2. Bearing Material: Manufacturer's standard antifriction bearing.
- 3. Grade 1 (heavy weight).
- 4. Base and Pin Metal:
 - a. Exterior Hinges: Stainless steel with stainless-steel pin.
 - b. Interior Hinges: Stainless steel with stainless-steel pin.
- 5. Pins: Non-rising loose unless otherwise indicated.
 - a. Outswinging Exterior Doors: Nonremovable.
 - b. Outswinging Corridor Doors with Locks: Nonremovable.
- 6. Tips: Flat button.
- 7. Corners: Square.

C. Plain-Bearing Hinges: Grade 3 (standard weight).

- 1. Mounting: Full mortise (butts).
- 2. Base and Pin Metal: Stainless steel with stainless steel pin.
- 3. Pins: Non-rising loose unless otherwise indicated.
- 4. Tips: Flat button Ball.
- 5. Corners: Square.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Provide mortise locksets for all doors.
- C. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
- D. Lock Backset: 2-3/4 inches unless otherwise indicated.
- E. Lock Trim:

1. Description: As indicated on Drawings As selected by Architect from manufacturer's full range of standard designs.
 2. Levers: Wrought, forged, or cast.
 - a. Construction: Solid.
 3. Escutcheons (Roses): Wrought, forged, or cast.
 4. Dummy Trim: Match lever lock trim and escutcheons.
- F. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
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. Allegion plc.
 - b. Best Access Systems; Stanley Security Solutions, Inc.
 - c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.
 - e. Yale Security Inc; an ASSA ABLOY Group company.

2.6 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
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. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
 - b. Allegion plc.
 - c. Burns Manufacturing Incorporated.
 - d. Don-Jo Mfg., Inc.
 - e. Door Controls International, Inc.
 - f. Hiawatha, Inc; a division of the Activar Construction Products Group.
 - g. INOX by Unison Hardware, Inc.
 - h. Trimco.
- B. Manual-Extension Flush Bolts: Grade 1, fabricated from extruded brass or aluminum, with 12-inch rod actuated by flat lever.

1. Strike: Dustproof.
- C. Dustproof Strikes: Grade 1 polished wrought brass, with 3/4-inch diameter, spring tension plunger.

2.7 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from stainless steel. Provide cylinder from same manufacturer of locking devices.
 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. Allegion plc.
 - b. Best Access Systems; Stanley Security Solutions, Inc.
 - c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.
 - e. Yale Security Inc; an ASSA ABLOY Group company.
- B. Standard Lock Cylinders: BHMA A156.5; permanent cores; face finished to match lockset.
 1. Core Type: Full size; interchangeable.
 2. Number of Pins: Six or seven.
 3. Lock Type: Mortise type.

2.8 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 1. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.
 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver or brass.

2.9 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.
- B. Overlapping-with-Gasket Astragals: BHMA A156.22; T-shaped metal, surface mounted on edge of door with screws.

1. Base Metal: Aluminum or stainless steel.
2. Gasket Material: Silicone.

2.10 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 instructions 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.
- B. Closers shall not be seen on the public side of the door. The appropriate drop plate or mounting plates will be used as conditions dictate.
 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. Allegion plc.
 - b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - c. DORMA USA, Inc.
 - d. Hager Companies.
 - e. Norton Door Controls; an ASSA ABLOY Group company.
 - f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
 - g. SARGENT Manufacturing Company; ASSA ABLOY.
 - h. Yale Security Inc; an ASSA ABLOY Group company.
- C. Surface Closer with Cover: Grade 1; Modern type with mechanism enclosed in cover.
 1. Mounting: Hinge side; parallel arm where required.
 2. Type: Regular or two-point hold-open arm with dead stop where required.
 3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
 4. Cover Material: Aluminum or molded plastic.
 5. Closing Power Adjustment: At least 35 percent more than minimum tested value.

2.11 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; stainless steel base metal.
 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. Allegion plc.
 - b. Architectural Builders Hardware Mfg., Inc.
 - c. Baldwin Hardware Corporation.
 - d. Burns Manufacturing Incorporated.
 - e. Cal-Royal Products, Inc.
 - f. Don-Jo Mfg., Inc.
 - g. Door Controls International, Inc.

- h. Hager Companies.
- i. Hiawatha, Inc; a division of the Activar Construction Products Group.
- j. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
- k. Trimco.

B. Rigid-Type Floor Stop: Grade 1; with rubber bumper.

- 1. Installation: Expansion-shield installation.

C. Dome-Type Floor Stop: Grade 1; with minimum 1-inch- high bumper for doors without threshold and 1-3/8-inch- high bumper for doors with threshold.

2.12 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Hager Companies.
- b. M-D Building Products, Inc.
- c. National Guard Products, Inc.
- d. Pemko Manufacturing Co.
- e. Reese Enterprises, Inc.
- f. Sealeze.
- g. Zero International, Inc.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

- 1. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
- 2. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

C. Rigid, Housed, Perimeter Gasketing: Sponge silicone Sponge neoprene Silicone bulb Polyurethane bulb Vinyl bulb gasket material held in place by housing; fastened to frame stop with screws.

- 1. Housing Material: Aluminum or stainless steel.

D. Door Sweeps: Neoprene Vinyl Polyurethane Silicone gasket material held in place by flat housing or flange; surface mounted to face of door with screws.

- 1. Housing or Flange Material: Aluminum or stainless steel.

2.13 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

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. Hager Companies.
- b. M-D Building Products, Inc.
- c. National Guard Products, Inc.
- d. Pemko Manufacturing Co.
- e. Reese Enterprises, Inc.
- f. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
- g. Sealeze.
- h. Zero International, Inc.

B. Saddle Thresholds: /

1. Type: Smooth or fluted top, barrier free.
2. Base Metal: Aluminum or stainless steel.

2.14 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

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. Allegion plc.
- b. Burns Manufacturing Incorporated.
- c. Don-Jo Mfg., Inc.
- d. Hager Companies.
- e. Hiawatha, Inc; a division of the Activar Construction Products Group.
- f. Inpro Corporation.
- g. Pawling Corporation.
- h. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
- i. Trimco.

- B. Kick Plates: 10 inches high by door width with allowance for frame stops.

2.15 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

- B. Silencers for Metal Door Frames: Grade 1; neoprene or rubber; minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.16 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, 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.
 - 4. Where fasteners attach to fire retardant treated lumber, use fasteners of stainless-steel min. Type 304 or hot dipped galvanized min. 2.0 oz per square foot.

2.17 FINISHES

- A. Provide finishes complying with BHMA A156.18. Unless otherwise noted, provide stainless steel (630) or satin chrome (626) finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
- B. 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.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
- 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. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of ventilating equipment and to comply with referenced accessibility requirements.
 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, and door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.7 DEMONSTRATION

- A. Engage Installer to train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

Hardware Set 1

- Hinges
- Passage Set
- Door Closer
- Threshold
- Perimeter Gasketing (Weather-stripping)
- Door sweep

Hardware Set 2

- Hinges
- Passage Set
- Door Closer

Hardware Set 3

- Hinges
- Privacy Set
- Floor Stop

Hardware Set 4

- Hinges
- Office Set
- Door Closer with Hold-Open
- Threshold
- Perimeter Gasketing (Weather-stripping)
- Door sweep

Hardware Set 5

- Hinges
- Office Set
- Dummy Trim
- Top & Bottom Flush Bolts on inactive leaf
- Door Closer with Hold-Open
- Threshold
- Perimeter Gasketing (Weather-stripping)
- Door sweep

END OF SECTION 087111

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 233714 "Motorized Louvers with Dampers" for louver with damper.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing according to AMCA 540.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.5 QUALITY ASSURANCE

- A. Standards: ACMA Standard 500 Certification for Air Performance and Water Penetration.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver:

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. Airolite Company, LLC (The);
 - b. All-Lite Architectural Products;
 - c. Arrow United;
 - d. American Warming and Ventilating; a Mestek Architectural Group company;
 - e. Greenheck Fan Corporation.
 - f. Industrial Louvers Inc.
 - g. Ruskin Company.

2. Louver Depth: 6 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:
 - a. Free Area: Not less than 9.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Point of Beginning Water Penetration: Not less than 1100 fpm.
 - c. Air Performance: Not more than 0.10-inch wg static pressure drop at 850-fpm free-area exhaust or intake velocity.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E 488/E 488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
 2. Horizontal Mullions: Provide horizontal mullions at joints.

- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Exterior flange unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
 - 3. Exterior Corners: Prefabricated corner units with mitered and with mullions at corners.
- G. Provide extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Framing systems.
 - 2. Suspension systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation reports for high-strength steel studs and tracks post-installed anchors and power-actuated fasteners.

1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

PART 2 - PRODUCTS

2.1 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.
 - 1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal unless otherwise indicated
 - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220 and ASTM C645, Section 10.
 - 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. ClarkDietrich.
 - b. Steel Network, Inc. (The).
 - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection 0.0329 inch.
 - 3. Depth: As indicated on Drawings.
- C. High-Strength Steel Studs and Tracks: Roll-formed with surface deformations to stiffen the framing members.
- 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. ClarkDietrich.
 - b. Steel Network, Inc. (The).
 - 2. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements 0.0147 inch.
 - 3. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide the following:
- 1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. 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) ClarkDietrich.
 - 2) Steel Network, Inc. (The).
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
- 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. ClarkDietrich.
 - b. Steel Network, Inc. (The).
 - 2. Minimum Base-Steel Thickness: 0.0329 inch.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch wide 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. ClarkDietrich.
 - b. Marino\WARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company; Stone Group of Companies.
 - f. Steel Construction Systems; Stone Group of Companies.
 - 2. Depth: As indicated on Drawings.

3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels:

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. ClarkDietrich.
 - b. Jaimes Industries.
 - c. Marino\WARE.
 - d. MBA Building Supplies.
 - e. MRI Steel Framing, LLC.
 - f. SCAFCO Steel Stud Company; Stone Group of Companies.
 - g. Steel Construction Systems; Stone Group of Companies.
2. Minimum Base-Steel Thickness: As indicated on Drawings.
3. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.

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. ClarkDietrich.
 - b. Marino\WARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company; Stone Group of Companies.
 - f. Steel Construction Systems; Stone Group of Companies.
2. Configuration: hat shaped.

2.2 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.
- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 1. Depth: As indicated on Drawings.
- D. Furring Channels (Furring Members):
 1. Hat-Shaped, Rigid Furring Channels: 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: 0.0179 inch.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLATION OF FRAMING SYSTEMS

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLATION OF SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

- a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

3.4 FIELD QUALITY CONTROL

- A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Gypsum wallboard.
 - 2. Gypsum ceiling board.
 - 3. Joint treatment materials.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 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. Gypsum Wallboard: ASTM C1396/C1396M.

- 1. Manufacturers: Subject to compliance with requirements, undefined:
 - a. CertainTeed Gypsum.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. PABCO Gypsum.
 - e. USG Corporation.
- 2. Thickness: 1/2 inch.
- 3. Long Edges: Tapered.

- B. Gypsum Ceiling Board: ASTM C1396/C1396M.

- 1. Manufacturers: Subject to compliance with requirements, undefined:
 - a. CertainTeed Gypsum.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. PABCO Gypsum.
 - e. USG Corporation.
- 2. Thickness: 1/2 inch.
- 3. Long Edges: Tapered.

2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.

- 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 setting-type taping compound.

- a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.4 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 1. Use screws with hot dipped galvanized coating for securing gypsum board to fire retardant treated lumber.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Apply single layer of gypsum panels to face of trusses in concealed attic space (above ceiling.) to provide required draftstopping.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings.
 - 2. Ceiling Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. 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."

3.5 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
 - 2. Thermoplastic-rubber base.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.

3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- 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. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 2. Flexco.
 3. Johnsonite; a Tarkett company.
 4. 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: in Toilet Room.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As indicated by manufacturer's designations.

2.2 THERMOPLASTIC-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. Johnsonite; a Tarkett company.
 4. Roppe Corporation, USA.

- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style B, Cove: in Toilet Room.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners.
- G. Inside Corners: Job formed or preformed.
- H. Colors: As indicated by manufacturer's designations.

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 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 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, 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. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches 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 in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 097700 - SPECIAL WALL SURFACING

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. Section Includes: Durable, decorative wall panels with smooth or textured finishes. Mounting hardware, adhesives, accessories and trims.
- B. Related Sections:
 - 1. Division 06 Section: Rough and Finish Carpentry.
 - 2. Division 09 Section: Gypsum Board Assemblies.

1.3 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. ASTM International:
 - 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 - 3. ASTM D638 Standard Test Method for Tensile Properties of Plastics.
 - 4. ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 5. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage, handling and preparation requirements and installation instructions.
- B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

1. Submit manufacturer's installation instructions.
- C. Samples: Submit selection and verification samples for finishes, colors and textures. Submit 2 samples of each type of panel, trim and fastener.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 1. Submit manufacturer's certificate that products meet or exceed specified requirements.
- B. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

1. Maintenance Data: for installed products including methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty documents specified herein.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have a minimum of 5 years' experience with composite wall panel work similar in scope and size to this project.

1.8 DELIVERY, STORAGE & HANDLING

- A. Lead Time: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 1. Store panels indoors.
 2. Lay panels flat. Do not stand panels on edge.
 3. Protect panels from moisture.
 4. Do not store panels in contact with the floor or against an outside wall.
 5. Do not remove protective film from panel surface until after installation (if applicable).
 6. Maintain optimum storage conditions of 60-75 degrees F (16-24 degrees C) at 35 - 55% relative humidity. Avoid extremes in temperature and humidity.
- D. Handling: Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.9 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Do not deliver or install composite wall panels and accessories until spaces are enclosed and weathertight, residual moisture from plaster, concrete or terrazzo work has dissipated, and interior temperature and humidity conditions are at occupancy levels during the remainder of the construction period.
2. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.
3. Do not install wall system until normal lighting conditions exist. Normal lighting conditions are described as those in place when the project is finished.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1. Wall, ceilings, floors and openings must be level, plumb, straight, in-line and square

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of composite wall panel system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of FRP surface beyond normal wear.

B. Warranty Period: 10 years from the Date of Substantial Completion.

1.11 EXTRA MATERIALS:

A. Provide five percent additional material for use by owner in building maintenance and repair.

PART 2 - PRODUCTS

2.1 COMPOSITE WALL PANELS

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. Manufacturer: Nudo
 - a. Contact: 1500 Taylor Avenue, Springfield, IL 62703; Telephone: (800) 826-4132, (217) 528-5636; Fax: (217) 528-8722; E-mail: info@nudo.com ; website: www.nudo.com
- B. Product Standard: Composite wall & ceiling panels, including the following:
 1. NuFiber™ Wall Panels: F3P500 Fiberglass Reinforced Plastic (FRP) sheet laminated to one side of plywood substrate
- C. Substrate Thickness: 0.500 inch.
- D. Surface Thickness: Not less than 0.030 inch.
- E. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
- F. Texture: As selected by Architect from manufacturer's range of smooth or pebbled.
- G. Color: As selected by Architect from manufacturer's full range.
- H. Size: 4 feet x 8 feet, 4 feet x 10 feet, or 4 feet by 12 feet as determined by contractor to produce the least number of horizontal seams when installed.

2.2 ACCESSORIES

- A. Fasteners: Provide appropriate fasteners and accessories as required to properly complete installation.
- B. Moldings: Provide manufacturer's recommended standard PVC moldings for division bars, inside and outside corner moldings and cap moldings.
 1. Color: As selected by Architect from manufacturer's full range.
- C. Rivets: in complimentary colors matching moldings in areas where there are large fluctuations in temperature and/or humidity, and/or where the substrate is unusually uneven.
- D. Sealant: Color matched acrylic latex caulk.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by removing packaging and allow panels to acclimate to room temperature and humidity of installation space for at least 48 hours.
- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
 - 1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
 - 2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. General:
 - 1. Field cutting of all wall systems should be accomplished using a circular saw with fine tooth carbide blade.
 - 2. Position panel so that the saw blade enters the finished HPL side first to avoid chipping or damage. Protect decorative laminate face of panel by covering work area, do not remove protection until after installation.
- B. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Mechanical fasteners shall be spaced no more than 24 inches on center.
 - 3. Apply sealant to fastener holes before installing fasteners.
- C. Install trim accessories with adhesive.

- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- G. Installation procedure:
 - 1. Starting in the corner, mark plumb line 48 1/8 inches from corner.
 - 2. Slide panel into molding and withdraw 1/8 inch to provide appropriate gap. Align with plumb line.
 - 3. Begin in top corner nearest molding apply fasteners down and out toward the edge without molding.
 - 4. Install one-piece division bar and caps or next molding by sliding onto panel, maintaining 1/8" gap for expansion or contraction.
 - 5. Repeat process, working in one direction around room.
- H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.4 FINAL CLEANING

- A. Clean panel surfaces in compliance with manufacturer's recommendations.
 - 1. Use a clean, damp, nonabrasive cotton cloth and a mild liquid detergent or household cleaner. Rinse with clean water and dry using soft, clean, nonabrasive cotton cloths.
 - 2. Do not use cleaners containing acid, alkali or sodium hypochlorite.

3.5 PROTECTION

- A. A. Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION 097700

SECTION 099100 - PAINTING

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 surface preparation and field painting of exposed exterior and interior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Metal lockers.
 - b. Finished mechanical and electrical equipment.
 - c. Fiberglass laminated to plywood.
 - d. Metal wall, roof, or liner panels.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Low Luster (Eggshell) refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Initial Selection: For each type of finish-coat material indicated.
 1. Provide manufacturer's paint deck for initial selection of paint colors.
 2. Where requested, match color of identified items to be incorporated in project.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 1. Provide 12 inch square Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

- B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.8 EXTRA MATERIALS

- A. Provide extra paint applied to surfaces. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Benjamin Moore & Co. (Benjamin Moore).
 - 2. PPG Industries, Inc. (Pittsburgh Paints).
 - 3. Sherwin-Williams Co. (Sherwin-Williams).
 - 4. Tnemec.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

- A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
 - 1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils.
 - 2. Benjamin Moore; Moore's IMC Latex Block Filler No. M88: Applied at a dry film thickness of not less than 8.1 mils.

3. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils.
4. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.4 EXTERIOR PRIMERS

A. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.

1. Benjamin Moore; Moore's Acrylic Masonry Sealer No. 066: Applied at a dry film thickness of not less than 0.7 mils.
2. Benjamin Moore; Moore's Alkyd Masonry Sealer No. 077: Applied at a dry film thickness of not less than 2.7 mils.
3. Pittsburgh Paints; 6-603 SpeedHide Interior/Exterior Acrylic Latex Alkali Resistant Primer: Applied at a dry film thickness of not less than 1.5 mils.
4. Sherwin-Williams; Loxon Exterior Masonry Acrylic Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils.
5. Sherwin-Williams; A-100 Latex Exterior Wood Primer B42W41: Applied at a dry film thickness of not less than 1.4 mils.

B. Exterior Wood Primer for Acrylic Enamels: Factory-formulated alkyd or latex wood primer for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Exterior Primer No. 176: Applied at a dry film thickness of not less than 1.8 mils.
2. Pittsburgh Paints; 6-609 SpeedHide Exterior House & Trim Wood Primer 100 Percent Acrylic Latex: Applied at a dry film thickness of not less than 1.6 mils.
3. Sherwin-Williams; A-100 Exterior Latex Wood Primer B42W41: Applied at a dry film thickness of not less than 1.4 mils.

C. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils.
2. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.
3. Sherwin-Williams; primer not required over this substrate.
4. Sherwin-Williams; Galvite HS Paint B50WZ3: Applied at a dry film thickness of not less than 2.0 mils.

2.5 INTERIOR PRIMERS

A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.

2. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
 3. Sherwin-Williams; PrepRite Masonry Primer B28W300: Applied at a dry film thickness of not less than 3.0 mils.
- B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
 2. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
 3. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils.
- C. Interior Wood Primer for Acrylic-Enamel and Semigloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.
1. Benjamin Moore; Moorcraft Super Spec Alkyd Enamel Underbody and Primer Sealer No. 245: Applied at a dry film thickness of not less than 1.5 mils.
 2. Pittsburgh Paints; 6-855 SpeedHide Latex Enamel Undercoater: Applied at a dry film thickness of not less than 1.0 mil.
 3. Sherwin-Williams; PrepRite Wall and Wood Primer B49W200 Series: Applied at a dry film thickness of not less than 1.6 mils.
 4. Sherwin-Williams; PrepRite Classic Interior Primer B28W101 Series: Applied at a dry film thickness of not less than 1.6 mils.

2.6 EXTERIOR FINISH COATS

- A. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils.
 2. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils.
 3. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils.
- B. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.
1. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel M28: Applied at a dry film thickness of not less than 2.0 mils.
 2. Pittsburgh Paints; 90-300 Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels: Applied at a dry film thickness of not less than 3.0 mils.
 3. Sherwin-Williams; DTM Acrylic Coating Gloss (Waterborne) B66W100 Series: Applied at a dry film thickness of not less than 2.4 mils.

2.7 INTERIOR FINISH COATS

- A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.
 - 1. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275: Applied at a dry film thickness of not less than 1.2 mils.
 - 2. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint: Applied at a dry film thickness of not less than 1.0 mil.
 - 3. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series: Applied at a dry film thickness of not less than 1.4 mils.
- B. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
 - 1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils.
 - 2. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils.
 - 3. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood.
 - c. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

- a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.

- B. **Scheduling Painting:** Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. **Application Procedures:** Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. **Brushes:** Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. **Rollers:** Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. **Spray Equipment:** Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. **Minimum Coating Thickness:** Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. **Mechanical and Electrical Work:** Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. **Block Fillers:** Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- G. **Prime Coats:** Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- H. **Pigmented (Opaque) Finishes:** Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

- I. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

- A. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.
 - a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- B. Smooth Wood and Trim: Provide the following finish systems over smooth wood siding, wood trim, and other smooth exterior wood surfaces:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Exterior wood primer for acrylic enamels.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

1. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer.
 - b. Finish Coats: Exterior full-gloss alkyd enamel.

3.7 INTERIOR PAINT SCHEDULE

A. Concrete Masonry Unit: Provide the following finish systems over interior concrete masonry:

1. Selected Walls including Toilet Room: High-Gloss Finish: One finish coat over an intermediate coat and a block filler.
 - a. Block Filler: Acrylic or epoxy block filler applied at spreading rate recommended by manufacturer as sufficient to fill pores.
 - 1) Moore: M88 Latex Block Filler.
 - 2) PPG: 16-90 Pitt-Glaze High Performance Acrylic Latex Block Filler.
 - 3) S-W: Heavy Duty Block Filler B42W46.
 - 4) Tnemec: Latex Masonry Block Filler.
 - b. Intermediate Coat: Acrylic enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.0 to 4.0 mils.
 - 1) Moore: M28 Acrylic Gloss Enamel.
 - 2) PPG: 90-3XX Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamel.
 - 3) S-W: DTM Acrylic Gloss Coating B66W100 Series.
 - 4) Tnemec: Series 28 Tuf-Cryl Water Based Acrylic Emulsion.
 - c. Topcoat: High-gloss acrylic enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.0 to 4.0 mils.
 - 1) Moore: M28 Acrylic Gloss Enamel.
 - 2) PPG: 90-3XX Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamel.
 - 3) S-W: DTM Acrylic Gloss Coating B66W100 Series.
 - 4) Tnemec: Series 28 Tuf-Cryl Water Based Acrylic Emulsion.

B. Gypsum Board Ceilings: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.

C. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a wood primer.
 - a. Primer: Interior wood primer for full-gloss alkyd-enamel finishes.

- b. Finish Coats: Interior full-gloss alkyd enamel for wood and metal surfaces.
- D. Ferrous Metal: Provide the following finish systems over ferrous metal:
 - 1. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior full-gloss alkyd enamel.
- E. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:
 - 1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coats: Interior flat latex-emulsion size.

END OF SECTION 099100

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Primers.
 - 2. Finish coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Behr Paint Company; Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Hempel (USA), Inc.
 - 4. Kelly-Moore Paints.
 - 5. PPG Paints; PPG Industries, Inc.
 - 6. Sherwin-Williams Company (The).
 - 7. Valspar; a brand of The Sherwin-Williams Company.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are 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, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- B. Colors: As selected by Owner from manufacturer's full range.

2.3 PRIMERS

- A. Exterior, Alkali-Resistant, Water-Based Primer: Pigmented, water-based primer formulated for use on alkaline surfaces, such as exterior plaster, vertical concrete, and masonry.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
 - g. Valspar; a brand of The Sherwin-Williams Company.
- B. Exterior, Latex Block Filler: Water-based, pigmented, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
 - g. Valspar; a brand of The Sherwin-Williams Company.
 - 2. Minimum Solids Content: Manufacturer's standard percentage solids by volume.
- C. Water-Based Bonding Primer: Pigmented, water-based-emulsion primer formulated for exterior use and to promote adhesion of subsequent specified coatings.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
 - g. Valspar; a brand of The Sherwin-Williams Company.
- D. Zinc-Rich, Inorganic Primer: Corrosion-resistant, inorganic-based, zinc-rich primer formulated for use on prepared steel subject to severe industrial or marine environments.

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. Hempel (USA), Inc.
 - b. PPG Paints; PPG Industries, Inc.
 - c. Sherwin-Williams Company (The).
- E. Alkyd Metal Primer: Corrosion-resistant, solvent-based, alkyd primer formulated for use on prepared ferrous metals subject to industrial and light marine environments.
 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. Benjamin Moore & Co.
 - b. Hempel (USA), Inc.
 - c. PPG Paints; PPG Industries, Inc.
 - d. Sherwin-Williams Company (The).
- F. Water-Based, Galvanized-Metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.
 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
- G. Epoxy Metal Primer: Corrosion-resistant, solvent-based, two-component epoxy primer formulated for use on prepared, exterior ferrous- and galvanized-metal surfaces.
 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. Benjamin Moore & Co.
 - b. Hempel (USA), Inc.
 - c. PPG Paints; PPG Industries, Inc.
 - d. Sherwin-Williams Company (The).
- H. Vinyl Wash Primer: Two-component, vinyl butyral/phosphoric acid, wash primer formulated for use over cleaned metal surfaces and zinc-rich primers as a tie coat for subsequent corrosion-resistant primers or finish coatings.
 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. Sherwin-Williams Company (The).

2.4 FINISH COATINGS

- A. Exterior Latex Paint, Flat: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as portland cement plaster, concrete, and primed wood.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
 - g. Valspar; a brand of The Sherwin-Williams Company.
 - 2. Gloss and Sheen: Manufacturer's standard flat finish .
- B. Exterior, High-Build Latex Paint: Water-based, high-build, pigmented, emulsion coating; high-solids content improves filling, uniformity, and film build on concrete masonry surfaces. Formulated for abrasion, mold, microbial, and wind-driven rain resistance and for use on exterior masonry, concrete masonry unit, and concrete surfaces.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. Kelly-Moore Paints.
 - e. Sherwin-Williams Company (The).
 - 2. Gloss and Sheen Level: Manufacturer's standard low-gloss finish .
 - 3. Minimum Solids Content: Manufacturer's standard percentage solids by volume.
- C. Textured Latex Coating, Flat: Water-based, pigmented coating that contains sand or other hard aggregate and is formulated for use on exterior masonry, concrete masonry unit, and concrete surfaces.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Hempel (USA), Inc.
 - d. PPG Paints; PPG Industries, Inc.
 - e. Sherwin-Williams Company (The).
 - 2. Gloss and Sheen Level: Manufacturer's standard flat finish.
 - 3. Aggregate Size: Manufacturer's standard .

- D. Exterior Alkyd Enamel, Flat: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
 - 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. Benjamin Moore & Co.
 - b. Rodda Paint Co.
 - 2. Gloss and Sheen Level: Manufacturer's standard flat finish.
- E. Exterior Alkyd Enamel, Semigloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
 - 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. Behr Paint Company; Behr Process Corporation.
 - b. Sherwin-Williams Company (The).
 - 2. Gloss Level: Manufacturer's standard semigloss finish.
- F. Exterior Alkyd Enamel, Gloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
 - 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. Benjamin Moore & Co.
 - b. Hempel (USA), Inc.
 - c. PPG Paints; PPG Industries, Inc.
 - d. Sherwin-Williams Company (The).
 - 2. Gloss Level: Manufacturer's standard gloss finish.
 - 3. Fineness of Grind: Manufacturer's standard.
- G. High-Build Epoxy Paint, Low Gloss: High-solids, two-component epoxy; formulated for use on exterior concrete, masonry, and primed-metal surfaces.
 - 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. Benjamin Moore & Co.
 - b. PPG Paints; PPG Industries, Inc.
 - c. Sherwin-Williams Company (The).
 - 2. Gloss and Sheen Level: Manufacturer's standard low-gloss finish.
- H. Exterior, Water-Based, Light Industrial Coating, Low Sheen: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.

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. Behr Paint Company; Behr Process Corporation.
 - b. PPG Paints; PPG Industries, Inc.
 - c. Sherwin-Williams Company (The).
 2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
- I. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
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. Behr Paint Company; Behr Process Corporation.
 - b. Sherwin-Williams Company (The).
 - c. Valspar; a brand of The Sherwin-Williams Company.
 2. Gloss Level: Manufacturer's standard semigloss finish.
- J. Exterior, Water-Based, Light Industrial Coating, Gloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
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. Behr Paint Company; Behr Process Corporation.
 - b. PPG Paints; PPG Industries, Inc.
 - c. Sherwin-Williams Company (The).
 2. Gloss Level: Manufacturer's standard gloss finish.

2.5 FLOOR SEALERS AND PAINTS

- A. Water-Based, Concrete-Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on exterior, concrete traffic surfaces.
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. Behr Paint Company; Behr Process Corporation.
 - b. Hempel (USA), Inc.
 - c. PPG Paints; PPG Industries, Inc.
 - d. Sherwin-Williams Company (The).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- B. 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 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
- 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. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. 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.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System:
 - a. Prime Coat: Exterior, alkali-resistant, water-based primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior latex paint, flat.
- B. Steel and Iron Substrates:
 - 1. Water-Based, Light Industrial Coating System:
 - a. Prime Coat.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior, water-based, light industrial coating, low sheen.
 - 2. Alkyd System:
 - a. Prime Coat: Surface-tolerant metal primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior alkyd enamel, flat.
- C. Galvanized-Metal Substrates:
 - 1. Water-Based, Light Industrial Coating System:
 - a. Prime Coat: Water-based, galvanized-metal primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior, water-based, light industrial coating, low sheen.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Primers.
 - 2. Water-based finish coatings.
 - 3. Solvent-based finish coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of topcoat product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Behr Paint Company; Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
 - 4. Kelly-Moore Paints.
 - 5. PPG Paints; PPG Industries, Inc.
 - 6. Sherwin-Williams Company (The).

2.2 PAINT PRODUCTS, GENERAL

- A. 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.
- B. Colors: As selected by Owner from manufacturer's full range.

2.3 PRIMERS

- A. Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.

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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
- B. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.
 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).

2.4 WATER-BASED FINISH COATS

- A. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
 - d. Kelly-Moore Paints.
 - e. PPG Paints; PPG Industries, Inc.
 - f. Sherwin-Williams Company (The).
 2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.

2.5 SOLVENT-BASED FINISH COATS

- A. Interior, Alkyd, Eggshell: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.
 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. Behr Paint Company; Behr Process Corporation.
 - b. Benjamin Moore & Co.
 - c. PPG Paints; PPG Industries, Inc.

- d. Sherwin-Williams Company (The).
- 2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- B. 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 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.
- C. 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 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
- 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. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. 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.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System:
 - a. Prime Coat: Alkali-resistant, water-based primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior latex paint, eggshell.
- B. Cement Board Substrates:
 - 1. Latex System:
 - a. Prime Coat: Alkali-resistant, water-based primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, eggshell.
- C. Gypsum Board Substrates:
 - 1. Latex over Latex Sealer System:
 - a. Prime Coat: Interior latex primer sealer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, eggshell.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems.
 - 1. Interior Substrates:
 - a. Concrete, vertical and horizontal surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Galvanized metal.
 - d. Aluminum (not anodized or otherwise coated).

1.2 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- C. 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. 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. Behr Paint Company; Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Coronado Paint; Benjamin Moore & Co.
 - 4. Corotech Coatings; Benjamin Moore & Co.
 - 5. International Protective Coatings; AkzoNobel.
 - 6. PPG Paints; PPG Industries, Inc.
 - 7. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, 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.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- C. Colors: As selected by Owner from manufacturer's full line.

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. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 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 coating 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.

- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Galvanized-Metal Substrates:
 - 1. Epoxy over Epoxy Primer System MPI INT 5.3D:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss, MPI #77.
- B. Concrete Substrates, Vertical Surfaces:
 - 1. Epoxy, High-Build System MPI INT 3.1P:
 - a. Prime Coat: High-build epoxy, matching topcoat (reduced).
 - b. Intermediate Coat: High-build epoxy, matching topcoat.
 - c. Topcoat: High-build epoxy, low gloss, MPI #108.
- C. Concrete Substrates, Ceiling Surfaces.
 - 1. Epoxy, High-Build System MPI INT 3.2L:
 - a. Prime Coat: High-build epoxy, matching topcoat (reduced).
 - b. Intermediate Coat: High-build epoxy, matching topcoat.
 - c. Topcoat: High-build epoxy, low gloss, MPI #108.
- D. CMU Substrates:
 - 1. Epoxy, High-Build System MPI INT 4.2R:
 - a. Prime Coat: Epoxy block filler, MPI #116.
 - b. Intermediate Coat: High-build epoxy, matching topcoat.
 - c. Topcoat: High-build epoxy, low gloss, MPI #108.

END OF SECTION 099600

SECTION 099700 – SPECIAL COATINGS

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 the work of this Section.

1.2 SUMMARY

- A. Work covered by this Section includes the furnishing and application of paints, stains, primers, varnishes, and other finish, decorative and protective coatings.
- B. Shop priming and factory pre-finishing are required on some, but not necessarily all, of the items described in other sections
- C. Extent of work:
 - 1. All new process equipment and process piping.
 - 2. All building and room surfaces as indicated on the plans or as scheduled.
 - 3. All conduits, ducts, drains, etc of other trades unless such product is deemed having an acceptable factory pre-finish, under the following conditions:
 - a. When exposed items are related to room surfaces scheduled to paint.
 - b. When specifically called out as requiring special coating protection.

1.3 DEFINITIONS

- A. Special coating systems are defined as those types of materials and methods of application requiring more than normal skills and techniques for mixing, handling and application, as specified in the "Painting" section.
 - 1. The term "special coating systems" as used in this section includes applied materials used in prime, intermediate and finish coats.
 - 2. The word "paint", as applied in this and or other Sections shall apply to all special coatings required herein for the protection of materials from corrosive environment, weathering processes, or for aesthetic or other reasons.
 - 3. The term "exposed surfaces" is defined to include areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place in areas to be coated. Extend special coatings in these areas as required to maintain the coating system integrity and provide desired protection.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.

1. List each material and cross-reference to the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
2. In the event that the submittal requests a substitution then the following ASTM test results from an independent testing laboratory for the referenced products shall be included: Performance Criteria:
 3. ASTM B 117 Salt Fog
 4. ASTM D 3359 (Method A and B) Adhesion Test
 5. ASTM G8, Method A Cathodic Disbondment
 6. ASTM D 4541 (Elcometer)
 7. ASTM D 4060 Taber Abrasion
 8. ASTM D 522 (Conical Mandrel)
 9. ASTM D 3363 Pencil Hardness
 10. ASTM D 2794 Impact
 11. ASTM G 53 QUV Exposure
 12. ASTM D 2240 Durometer, Shore D
 13. ASTM D 870 Immersion (Potable Water)
 14. ASTM E 96 Moisture Vapor Transmission
 15. ASTM D 2370 Tensile Strength and Elongation
 16. ASTM D 638 Tear Strength
- B. Manufacturer's representative color and texture sample cards shall be submitted to the Engineer at least 30 days prior to paint application. Contractor shall coordinate work so as to allow sufficient time for paint to be delivered to the job site.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide primers and other undercoat material produced by the same manufacturer as the finish coats. Use only thinners recommended by the manufacturer, and only within recommended limits.
- B. Coordination of Work: Review other sections of these specifications in which other coatings are to be provided to ensure compatibility of the total coatings systems for various substrates.
 1. Upon request, furnish information on the characteristics of pre-primed materials, to ensure that provisions for specified finish coats can be appropriately applied.
 2. Notify the Engineer of any anticipated problems involved in using the coatings systems as specified.
- C. Job Mock-up:
 1. Minimum 50 sq.ft. application of each specified coating system on each type of substrate. At Engineer's discretion.
 2. Mock-ups will serve as standard for acceptance of work.
 3. Leave approved mock-ups in place as part of completed project.
 4. Manufacturer's representative shall be available to advise applicator on proper application techniques and procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Name or title of material.
 - 2. Federal Specification number, if applicable.
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Manufacturer's name.
 - 5. Contents by volume, for major pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.
 - 9. Handling instructions and precautions.
- B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 deg. F (7 deg. C) in a well ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all necessary precautionary measures to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of stains.
- C. No material shall be applied unless the containers are opened in the presence of the Owner's Representative.

1.7 PROJECT CONDITIONS

- A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 45 deg. F (7 deg. C), unless otherwise permitted by manufacturer's printed instructions.
- B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85%, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing with the coating operation.
 - 1. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and the temperature within the area can be maintained within limits specified by the manufacturer during application and drying periods.
- C. Report to responsible person such as safety personnel, General Trades Superintendent, etc., any condition which may pose a threat to the health and welfare of employees.
- D. Keep working area clean and safe.
- E. Obey all job site rules and regulations.
- F. Surfaces not to be painted; unless specifically stated otherwise:

1. Face brick
2. Pre-finished wall panels, partitions and ceiling tile
3. Items with acceptable factory-applied final finish
4. Concealed ducts, pipes and conduit.
5. Glass, Aluminum, Copper, Bronze, Stainless Steel

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 1. Tnemec Company, Inc., North Kansas City, Missouri
 2. Carboline Company, At. Louis, Missouri
 3. Sherwin Williams Company, Cleveland, Ohio
- B. Material Quality: Provide the best quality grade of the various types of coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- C. Proprietary names to designate colors or materials are not intended to imply that products of named manufacturers are required to the exclusion of equivalent products of other manufacturers.
- D. Request for substitution shall include manufacturer's literature for each product giving the name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified test reports showing results to equal the performance criteria of the products listed herein.

2.2 COATING SYSTEMS

- A. Ferrous Metal:
1. Submerged, Non-Potable
- Surface Preparation: SSPC-10 Near White Blast
- First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
- Carboline Carboguard 890 @ 3.0-5.0 DFT
- Sherwin Williams Dura-Plate 235 at 3.0-5.0 mils DFT
- Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 6.0-8.0 mils dry
- Carboline Carboguard 890 @ 4.0-6.0 DFT
- Sherwin Williams Dura-Plate 235 @ 5.0-8.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-10 and spot prime with Series 161 @3-5 mils dry or Carboline Carboguard 890 @ 3.0-5.0 DFT or Sherwin Williams Dura-Plate 235 @ 3.0-5.0 mils DFT.

2. Submerged, Potable
Surface Preparation: SSPC-SP10 Near White Blast
First Coat: Tnemec Series N140-1255 Pota-Pox Plus @ 4.0-6.0 mils dry
Carboline Carboguard 891 @ 4.0-6.0 DFT
Sherwin Williams Macropoxy 646 PW @ 4.0-6.0 mils DFT
Second Coat: Tnemec Series N140-15BL Pota-Pox Plus @ 6.0-8.0 mils dry
Carboline Carboguard 891 @ 6.0-10.0 DFT
Sherwin Williams Macropoxy 646 PW @ 6.0-8.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-10 and spot prime with Series N140 @ 3-5 mils dry or Sherwin Williams Macropoxy 646 PW @ 3.0-5.0 mils DFT.

3. Non-Submerged, Interior Exposure
Surface Preparation: SSPC-SP6 Commercial Blast
First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
Carboline Carboguard 60 @ 3.0-5.0 DFT
Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT
Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 4.0-6.0 mils dry
Carboline Carboguard 60 @ 4.0-6.0 DFT
Sherwin Williams Macropoxy 646 @ 4.0-6.0 mild DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-10 and spot prime with Series N69 @ 3-5 mils dry or Carboline Carboguard 60 @ 3.0-5.0 DFT or Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT.

4. Non-Submerged, Exterior Exposure
Surface Preparation: SSPC-SP6 Commercial Blast
First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry
Carboline Carboguard 60 @ 3.0-5.0 DFT
Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT
Second Coat: Tnemec Series 1075 Endura-Shield II @ 2.0-4.0 mils dry
Carboline Carbothane 133 LH @ 3.0-5.0 DFT
Sherwin Williams Acrolon 218 HS or Hi-Solids Polyurethane @ 3.0-5.0 mils DFT

NOTE: If shop primed, field surface preparation for weld seams and abraded areas is SSPC-SP-6 and spot prime with Series N69 @ 3-5 mils dry or Carboline Carboguard 60 @ 3.0-5.0 DFT or Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT.

5. Galvanized Steel (including Bar Joist and Galvanized Steel)
Surface Preparation: SSPC-SPI Solvent Clean on galvanized surfaces.
SSPC-SP7 Bruss-Off blast to lightly profile surface.
First Coat: N69 Hi-Build Epoxoline II @ 2.0-4.0 mils dry
Carboline Carboguard 888 @ 3.0-4.0 DFT
Sherwin Williams Macropoxy 646 @ 3.0-4.0 mils DFT

B. Non-Ferrous Metals:

1. Interior Exposure

Surface Preparation: SSPC-SP1 Solvent Clean and Scarify per SSPC-SP 3

First Coat: Tnemec Serise N69 Hi-Build Epoxoline II @ 2.0-3.0 mils dry

Carboline Carboguard 60 @ 3.0-5.0 DFT

Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT

Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 3.0-5.0 mils dry

Carboline Carboguard 60 @ 3.0-5.0 DFT

Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT

2. Exterior Exposure

Surface Preparation: SSPC-SP1 Solvent Clean and Scarify per SSPC-SP 3

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 2.0-3.0 mils dry

Carboline Carboguard 60 @ 3.0-5.0 DFT

Sherwin Williams Macropoxy 646 @ 3.0-5.0 mils DFT

Second Coat: Tnemec Series 1075 Endura-Shield @ 2.0-4.0 mils dry

Carboline Carbothane 133 LH @ 3.0-5.0 DFT

Sherwin Williams Acrolon 218 HS or Hi-Solids

Polyurethane @ 3.0-5.0 mils DFT

C. Concrete

1. Submerged, Non-Potable

Surface Preparation: SSPC-SP 13 /NACE#6 "Surface Preparation of Concrete"

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft./ gal.
Carboline Carboguard 890 @ 150 sq.ft./gal.

Sherwin Williams Dura-Plate 235 @ 150 sq.ft./gal.

Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft./gal.

Carboline Carboguard 890 @ 150 sq.ft./gal.

Sherwin Williams Dura-Plate 235 @ 150 sq.ft./gal.

2. Waterproofing – See Specification Section 071116

3. Non-Submerged, poured in place or precast, Interior Exposure

Surface Preparation: Clean and dry

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft./gal.
Carboline Carboguard 60 @ 150 sq.ft./gal.

Sherwin Williams Macropoxy 646 @ 150 sq.ft./gal.

Second Coat: Series N69 Hi-Build Epoxoline II @ 150 sq.ft./gal.

Carboline Carboguard 60 @ 150 sq.ft./gal.

Sherwin Williams Macropoxy 646 @ 150 sq.ft./gal.

4. Non-Submerged, poured in place or precast, Exterior Exposure

Surface Preparation: Clean and dry

First Coat: Tnemec Series 156 Envirocrete @ 150 sq.ft./gal.

Carboline Flexxide Elastomer @ 150 sq.ft./gal.

Sherwin Williams Loxon XP @ 6.0-8.0 mils DFT

Second Coat: Tnemec Series 156 Envirocrete @ 150 sq.ft./gal.

Carboline Flexxide Elastomer @ 150 sq.ft./gal.
Sherwin Williams Loxon XP @ 6.0-8.0 mils DFT

5. Concrete block walls, Interior Exposure

Surface Preparation: Clean and dry

First Coat: Tnemec Series 130-6601 Envirofill @ 75 sq.ft./gal.
Carboline Sanitile 600 @ 75 sq.ft./gal.
Sherwin Williams Cement Plex 875

NOTE: Material should be rolled, or sprayed and back rolled, then squeegeed to provide a smoother surface.

Second Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft./gal.
Carboline Carboguard 60 @ 150 sq.ft./gal.
Sherwin Williams Macropoxy 646 @ 150 sq.ft./gal.

Third Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 150 sq.ft./gal.
Carboline Carboguard 60 @ 150 sq.ft./gal.
Sherwin Williams Macropoxy 646 @ 150 sq.ft./gal.

6. Concrete block walls, Exterior Exposure

Surface Preparation: Clean and dry

First Coat: Tnemec Series 156 Envirocrete @ 100 sq.ft./gal.
Carboline Flexxide Elastomer @ 100 sq.ft./gal.
Sherwin Williams Loxon XP @ 6.0-8.0 mils DFT

Second Coat: Tnemec Series 156 Envirocrete @ 100 sq.ft./gal.
Carboline Flexxide Elastomer @ 100 sq.ft./gal.
Sherwin Williams Loxon XP @ 6.0-8.0 mils DFT

7. Floors

Surface Preparation: SSPC-SP 13/NACE#6 "Surface Preparation of Concrete"

First Coat: Tnemec Series 201 Epoxoprime @ 250 sq.ft./gal.
Carboline Carboguard 1340 @ 3.0-4.0 DFT
Sherwin Williams GP 3579 @ 6.0-8.0 mils DFT

Second Coat: Tnemec Series 280 Tnem-Glaze @ 150 sq.ft./gal. If non-skid is desired, then randomly broadcast with 30/50 mesh silica sand into wet epoxy intermediate.
Carboline Sanitile 944 HB @ 6.0-8.0 DFT
Sherwin Williams GP 3745 @ 6.0-8.0 mils DFT

Third Coat: Tnemec Series 291 CRU @ 250 sq.ft./gal.
Carboline Sanitile 934 @ 2.0-3.0 DFT
Sherwin Williams GP 4638 @ 3.0-4.5 mils DFT

8. Foundations

Surface Preparation: Clean and dry

First Coat: Tnemec Series 46H-413 80 sq.ft./gal.
Carboline Bitumastic 300 M @ 80 sq.ft./gal.
Sherwin Williams Hi-Mil Sher-Tar @ 80 sq.ft./gal.

D. Plaster and Gypsum Wallboard

Surface Preparation: Clean and dry

First Coat: Tnemec Series 51-792 PVA Sealer @ 275 sq.ft./gal.
Carboline Carbocrylic 120 @ 1.0-2.0 DFT
Sherwin Williams Pro Mar 200 Laztex Primer @ 1.0-2.0 mils DFT

Second Coat: Tnemec Series 113 Tneme-Tufcoat @ 200 sq.ft./gal.
 Carboline Sanitile 255 @ 200 sq.ft./gal.
 Sherwin Williams Pro Industrial Hi-Build Waterbased
 Catalyzed Epoxy @ 4.0-6.0 mils DFT

Third Coat: Tnemec Series 113 Tneme-Tufcoat @ 200 sq.ft./gal.
 Carboline Sanitile 255 @ 200 sq.ft./gal.
 Sherwin Williams Pro Industrial Hi-Build Waterbased
 Catalyzed Epoxy @ 4.0-6.0 mils DFT

E. Wood

Surface Preparation: Clean and dry

First Coat: Tnemec Series 36-603 Undercoater @ 300 sq.ft./gal.
 Carboline Carbocrylic 120 @ 1.0-2.0 DFT
 Sherwin Williams Multi-Purpose Primer @ 1.0-2.0 mils
 DFT

Second Coat: Tnemec Series 23 Enduratone @ 400 sq.ft./gal.
 Carboline Carbocoat 8215 @ 400 sq.ft./gal.
 Sherwin Williams Pro Mar 200 Alkyd @ 400 sq.ft./gal.

Third Coat: Tnemec Series 23 Enduratone @ 400 sq.ft./gal.
 Carboline Carbocoat 8215 @ 400 sq.ft./gal.
 Sherwin Williams Pro Mar 200 Alkyd @ 400 sq.ft./gal.

F. PVC Pipe

Surface Preparation: Lightly sand

First Coat: Tnemec Series N69 Hi-Build Epoxoline II @ 200 sq.ft./gal.
 Carboline Carboguard 60 @ 200 sq.ft./gal.
 Sherwin Williams Macropoxy 646 @ 200 sq.ft./gal.

G. Insulated Pipe

Surface Preparation: Clean and dry

First Coat: Tnemec Series 1029 Enduratone @ 300 sq.ft./gal.
 Carboline Carbocrylic 3359 @ 300 sq.ft./gal.
 Sherwin Williams DTM Acrylic @ 2.5-4.0 mils DFT

Second Coat: Tnemec Series 1029 Enduratone @ 300 sq.ft./gal.
 Carboline Carbocrylic 3359 @ 300 sq.ft./gal.
 Sherwin Williams DTM Acrylic @ 2.5-4.0 mils DFT

H. Insulated Pipe

Surface Preparation: Clean and dry

First Coat: Tnemec Series 27 F.C. Typoxy @ 400 sq.ft./gal.
 Carboline Sanitile 120 @ 400 sq.ft./gal.
 Sherwin Williams Pro Industrial Pro Cryl Primer @ 400
 sq.ft./gal.

Second Coat: Tnemec Series 113 Tneme-Tufcoat @ 325 sq.ft./gal
 Carboline Carboguard 60 @ 325 sq.ft./gal.
 Sherwin Williams Pro Industrial Hi-Build Waterbased
 Catalyzed Epoxy @ 4.0-6.0 mils DFT

2.3 COLOR CODING AND PROCESS SYSTEM IDENTIFICATION

A. Color coding for processing piping, equipment and appurtenances is a suggested system unless otherwise specified or requested by Owner. Final coding to be determined in the field:

1. Equipment - light gray with O.S.H.A. orange coupling guards and O.S.H.A. yellow belt guards.
2. Pipe Supports - hangers to be same color as piping applied, floor post to be same as adjacent wall color, and fabricated racks to be manufacturer's standard protective finish or paint same as adjacent wall color if not having a suitable protective finish.
3. Process piping-exposed interior or exterior:
 - a. Submerged Pipe or Supports – Black
 - b. Intermittently Submerged Metals - Black (unless piping as defined otherwise)
 - c. Natural Gas - OSHA Red*
 - d. Process/L.P. Gas - OSHA Orange
 - e. Potable (City) water - OSHA Blue*
 - f. Well or Non-Potable Water - Aqua
 - g. Seal water, wash water — white plant effluent
 - h. Raw wastewater - Medium Grey*
 - i. Equipment drains - Black
 - j. Sanitary drains - Black with tags
 - k. Chemical feed - Aqua
 - l. Vents Ivory
 - m. Compressed air - Green
 - n. Chlorine - OSHA Yellow w/Red Stripes*
 - o. Raw Sewage - Light Gray
 - p. Grit Light Gray w/Yellow Stripes
 - q. Primary Sludge - Dark Brown
 - r. Return Sludge - Black w/Brown Stripes
 - s. Waste Sludge or Liquor - Dark Green*
 - t. Supernatant - OSHA Green
 - u. Fuel Oil - Dark Gray
 - v. Sample Lines - Light Blue
 - w. Fire Protection System - OSHA Red Sprinkler Piping
 - x. Hoist and Trolleys - OSHA Yellow
- * These colors are recommended as standard by WEF.
4. Miscellaneous, non-process related items such as electrical conduit, duct work, roof drains, etc. are to be properly prepped and finished to match adjacent wall or ceiling color in rooms scheduled for finish wall and/or ceiling paint.
5. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six (6) inch band of contrasting color shall be on one of the pipes at approximately thirty (30) inch intervals.

B. Signs and Labels

1. There shall be stenciled on each pipeline in each room a minimum of two legends describing the function of the pipeline, such as "natural gas", on each side of the pipe. It is intended that all pipelines shall bear legend at the most visible point and

meet ANSI A13.1 Scheme for the identification of piping system for size, type and vantage point of legends.

2. Signs shall be furnished and securely fastened to each pipeline showing its destination such as "Aeration Tank No. 1".
3. Where the flow of a pipeline is in one direction only, then a flow arrow shall be stenciled in front of each legend on the pipe.
4. For pipes smaller than 1 in. in outside diameter, a white plastic tag with black lettering shall be used.
5. The legends and flow arrows shall be stenciled with approved stencil paint. Following the completion of other work under this Item, all stencils used shall remain the property of the Owner.
6. Each hydrant, hose bib, sillcock, and yard hydrant connected to plant water shall be stenciled with the words "Unsafe Water - Do Not Drink". The size of the stenciled letters shall be 1 inch. Stencil on the hydrants is to be on the nozzle section. The hose bibs shall have a 15" x 5" x 1/2" thick plaque made of marine plywood, where the stenciled letters are to be applied. The Plaque shall be fastened to the structure directly above the hose bib connection, (Plaques to have white letters with aqua background).
7. Preprinted plastic-coated adhesive labels may be used in lieu of stencils, on interior piping only.
8. All rooms in which equipment is operated automatically shall have signs mounted on the walls which are visible at entrances. The Contractor shall furnish twenty 14 in. x 20 in. black or yellow porcelain signs meeting OSHA requirements. Signs shall include mounting accessories. Each sign shall read:

Warning: The equipment in this room operates automatically and may start or stop at any time.

PART 3 - EXECUTION

3.1 PRE-WORK INSPECTION

- A. Examine surfaces to be coated and report conditions that would adversely affect appearance or performance of coating systems and which cannot be put into an acceptable condition by preparatory work specified in Paragraph 3.2.
- B. Do not proceed with surface preparation and application until surface is acceptable or authorization to proceed is given by the Owner's representative.

3.2 SURFACE PREPARATION

- A. General:
 1. Dislodge dirt, rust, plaster nibs, mortar spatter and other dry material by scraping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming or blowing with high-pressure air.
 2. Remove oil, wax and grease by scraping off heavy deposits and cleaning with mineral spirits or a hot trisodium phosphate solution followed by a water rinse.

3. Verify that surfaces to be coated are dry, clean and free of dust, dirt, oil, wax grease or other contaminants.
- B. Non-Submerged Concrete, Masonry and Cement Stucco:
1. Allow new concrete and masonry to cure 28 days
 2. Scrape and grind fins and protrusions flush with surface.
 3. Patch holes and cracks flush with surface.
 4. Rake mortar joints clean.
- C. Plaster:
1. Allow to cure for 28 days.
 2. Remove nibs and other protrusions by scraping flush with surface.
 3. Patch voids and cracks with spackling compound to match texture or surface.
- D. Gypsum Board:
1. Sand joint compound smooth and flush with surface using fine grit sand paper.
 2. Fill nicks, scratches, holes and uneven spots with spackling compound and after dry, sand flush with surface.
- E. Non-Ferrous Metal:
1. SSPC-SPI solvent cleaning to remove all contaminants.
- F. Ferrous Metal:
1. Enclosed: Remove loose rust, mill scale and other foreign matter by hand (SSPC-SP2) or power tool (SSPC-SP3) cleaning and apply specified coating before rusting occurs.
 2. Non-Submerged, Architecturally Exposed: Society of Protective Coatings, SSPC-SP6 Commercial Blast.
 3. Submerged Steel: Society of Protective Coatings, SSPC-SP10 Near White Blast.
- G. Galvanized Metal:
1. Remove contaminants and protective mill coating by SSPC-SP1 Solvent Cleaning or steam cleaning. All surfaces shall be prepared by light brush blasting to achieve a minimum 1.0 mil abrasive blast profile
- H. Wood:
1. Remove surface deposits of sap and pitch by scraping and cleaning with mineral spirits.
 2. Seal knots and pitch pockets with a product manufactured for this specific purpose.
 3. Sand rough spots of smooth siding and finish woodwork.
 4. After prime coat is dry, fill cracks, holes and scratches with suitable wood filler or spackling compound and when dry, sand flush with surface.
 5. Sand lightly between coats.

I. Concrete Floors:

1. Prepare concrete floors in accordance with SSPC-SP 13/NACE #6 "Surface Preparation of Concrete".

J. Submerged Concrete:

1. Prepare in accordance with SSPC-SP 13/NACE #6 "Surface Preparation of Concrete" to remove laitance and expose all cavities and honeycombs. If immersion service condition will have an exposure outside of neutral pH (6-9) then all cavities shall be filled using Tnemec Series 218 Mortarclad or Sherwin Williams Corobond 300. Product is trowel applied to all vertical walls with exposed cavities.

3.3 APPLICATION

- A. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators in accordance with the manufacturer's directions. brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
1. Coating colors, surfaces treatments and finishes are indicated in the "Schedules" of the contract documents.
 2. Provide finish coats that are compatible with the primers used.
 3. The number of coats and coating film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the coating manufacturer. Sand between coating applications where sanding is required to produce an even smooth surface in accordance with the coating manufacturer's directions.
 4. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
 5. Coat the back sides of access panels, removable or hinged covers, and similar hinged items, to match exposed surfaces.
- B. Minimum Coating Thickness: Apply each material at not thinner than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire coating system as recommended by the manufacturer.
- C. Prime Coats: Before the application of finish coats, apply a prime coat, as recommended by the coating manufacturer, to material that is required to be painted or finished, and which has not been prime coated by others.
1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- D. Brush Application: Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

1. Apply primers and first coats by brush unless the manufacturer's instructions permit use of mechanical applicators.
- E. Mechanical Applications: Use mechanical methods for coating application when permitted by the coating manufacturer's recommendations, governing ordinances, and trade union regulations.
 1. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended by the coating manufacturer.
- F. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or recoat work not in compliance with specified requirements.
- G. Spray application will not be permitted for the Primary Clarifier Painting bid item.

3.4 INSPECTION

- A. Request acceptance of each coat before applying succeeding coats.
- B. The Contractor shall furnish the Engineer a suitable thickness detector of a type recommended by the paint manufacturer.
- C. Any field painting found to be defective shall be removed and the surfaces repainted as the Engineer may direct at no additional cost to the Owner.
- D. Before final approval of the work, all damaged surfaces of paint (field or factory applied) shall be cleaned and repainted or touched up as directed.

3.5 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following material testing procedure at any time, and at any number of times during the period when coating operations are being conducted.
 1. The Owner will engage the services of an independent testing laboratory to sample the coating being used. Samples of material delivered to project site will be taken, identified and sealed, and certified in the presence of the Contractor.
 2. The testing laboratory will perform appropriate tests for any or all of the following characteristics as required by the Owner:
 - a. Quantitative materials analysis.
 - b. Absorption.
 - c. Accelerated weathering.

3.6 CLEANING

- A. Clean-Up: At the end of each work day during progress of work, remove rubbish, empty cans, rags and other discarded materials from the site.
1. Upon completion of the work, clean window glass and other spattered surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or otherwise damage adjacent finished surfaces.

3.7 PROTECTION

- A. Protect work of other trades, whether to be coated or not, against damage from coating operations. Correct damage by cleaning, repairing or replacing, and recoating as acceptable to the Engineer. Leave the work in an undamaged condition.
- B. Provide "Wet Paint" signs as required to protect newly-coated finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.
1. At completion of the work of other trades, touch-up and restore damaged or defaced coated surfaces.

3.8 SCHEDULE

- A. Piping, Equipment and Concrete Tank Surfaces:

<u>Item</u>	<u>Coating System</u>
New above ground piping	2.2 A.4.
New unfinished or factory primed equipment	2.2 A.3. or 2.2 A.4.

- B. For new equipment, refer to individual specifications for extent of factory priming and/or painting.

END OF SECTION 099700

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Underlavatory guards.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Project Schedule: Indicating types, quantities, sizes and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 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. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - d. Brey-Krause Manufacturing Co.
 - e. GAMCO Specialty Accessories; a division of Bobrick.
 - f. Tubular Specialties Manufacturing, Inc.
 - 2. Description: Double-roll dispenser.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Noncontrol delivery with standard spindle.
 - 5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- C. Paper Towel (Folded) Dispenser:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - d. Brey-Krause Manufacturing Co.
 - e. GAMCO Specialty Accessories; a division of Bobrick.
 - f. Tubular Specialties Manufacturing, Inc.
 - 2. Mounting: Surface mounted.
 - 3. Minimum Capacity: 400 C-fold or 525 multifold towels.

4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at sides or front.

D. Automatic Paper Towel (Roll) Dispenser:

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. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. GAMCO Specialty Accessories; a division of Bobrick.
2. Description: Automatic motion sensing mechanism with user-adjustable delay and paper towel length; battery powered.
3. Mounting: Surface mounted.
4. Minimum Capacity: 8-inch- wide, 800-foot- long roll.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) ABS plastic, gray.
6. Lockset: Tumbler type.

E. Waste Receptacle:

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. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Brey-Krause Manufacturing Co.
 - f. GAMCO Specialty Accessories; a division of Bobrick.
 - g. Rubbermaid.
 - h. Tubular Specialties Manufacturing, Inc.
2. Mounting: Freestanding.
3. Minimum Capacity: 8 gal..
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Liner: Disposable plastic liner.
6. Lockset: Tumbler type for waste receptacle.

F. Grab Bar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - d. Brey-Krause Manufacturing Co.
 - e. GAMCO Specialty Accessories; a division of Bobrick.
 - f. Seachrome Corporation.
 - g. Tubular Specialties Manufacturing, Inc.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

G. Coat Hook:

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. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Brey-Krause Manufacturing Co.
 - f. GAMCO Specialty Accessories; a division of Bobrick.
 - g. Tubular Specialties Manufacturing, Inc.
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

H. Mirror Unit:

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. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Brey-Krause Manufacturing Co.
 - f. GAMCO Specialty Accessories; a division of Bobrick.
 - g. Tubular Specialties Manufacturing, Inc.
2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized steel, wall hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
4. Size: 24" x 36".

2.2 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

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. Buckaroos, Inc.
 - b. Plumberex Specialty Products, Inc.
 - c. 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.

2.3 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to 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, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104416 – FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Certifications

1. Conform to NFPA-10 requirements for extinguishers.
2. Provide units conforming with ANSI/UL 711 and ANSI/UL 92.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following or approved equal:
1. JL Industries.
 2. Larsens Manufacturing Co.
- B. Substitutions: Submit under provisions of Section 016600.

2.2 FIRE EXTINGUISHERS

- A. Multi-purpose dry chemical type U.L. 299, (ammonium phosphate), with pressure gauge.
1. Capacity: 10.0 lbs.
 2. U.L. Rating: 4A:60B:C
- B. Mounting bracket: Manufacturer's standard.

2.3 FINISHES

- A. Extinguisher: Red enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install using skilled workmen in accordance with manufacturer's printed instructions.

END OF SECTION 104416

SECTION 220500 - BASIC MECHANICAL 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. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, 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.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 40 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.

2.3 JOINING MATERIALS

- A. Refer to individual Division 40 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. 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.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

D.

1. Manufacturers:

a. Thompson Plastics, Inc.

E. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.

b. NIBCO, Inc.; Chemtrol Div.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.

b. Fernco, Inc.

c. Mission Rubber Company.

d. Plastic Oddities, Inc.

2.5 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.

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.

- b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
- G. 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.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 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.

2.8 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. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.9 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 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 40 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

- g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Edit pipe size range in first two subparagraphs below to suit Project. Confirm that PVC materials are allowed for sleeves by fire authorities having jurisdiction.
 - b. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - c. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - d. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Sections for flashing materials and installation.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- P. 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.

- Q. 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.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Sections for materials and installation.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 40 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.

3.3 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.

3.4 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.

3.5 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section "Painting".
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

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 specified in Division 3 Section "Cast-in-Place Concrete".

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for 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.

END OF SECTION 220500

SECTION 220519 - METERS AND GAGES

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 meters and gages for mechanical systems:
 - 1. Thermometers.
 - 2. Gages.
 - 3. Test plugs.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.

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, provide products by one of the manufacturers specified.

2.2 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

- A. Manufacturers:
 - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 2. KOBOLD Instruments, Inc.
 - 3. Marsh Bellofram.
 - 4. Terice, H. O. Co.
 - 5. Weiss Instruments, Inc.
 - 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

- B. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
- C. Element: Bourdon tube or other type of pressure element.
- D. Movement: Mechanical, connecting element and pointer.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red or other dark-color metal.
- G. Window: Glass.
- H. Ring: Metal.
- I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

- A. Manufacturers:
 - 1. AMETEK, Inc.; U.S. Gauge Div.
 - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - 3. Ernst Gage Co.
 - 4. Marsh Bellofram.
 - 5. Miljoco Corp.
 - 6. NANMAC Corporation.
 - 7. Noshok, Inc.
 - 8. Palmer - Wahl Instruments Inc.
 - 9. REO TEMP Instrument Corporation.
 - 10. Tel-Tru Manufacturing Company.
 - 11. Trerice, H. O. Co.
 - 12. Weiss Instruments, Inc.
 - 13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 14. WIKA Instrument Corporation.
 - 15. Winters Instruments.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Manufacturers:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Metal.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers:

1. Flow Design, Inc.
2. MG Piping Products Co.

3. National Meter, Inc.
 4. Peterson Equipment Co., Inc.
 5. Sisco Manufacturing Co.
 6. Trerice, H. O. Co.
 7. Watts Industries, Inc.; Water Products Div.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
 2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Install thermometers, gages, and test plugs as indicated on the plans and other specification sections.
- B. Provide the following temperature ranges for thermometers:
1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
 2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
 3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.

3.2 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage (except steam).

3.3 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.4 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 220519

SECTION 220523 -VALVES

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 general-duty valves.
- B. Related Sections include the following:
 - 1. Division 33 piping Sections for general-duty and specialty valves for site construction piping.
 - 2. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PTFE: Polytetrafluoroethylene plastic.
 - 5. SWP: Steam working pressure.
 - 6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- D. CPVC True Union Ball Valves: 2-inches and smaller with socket or threaded ends, and pressure rating not less than 150 psi. NSF certified for potable water use.
- E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
 - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.

2. Gear Drive: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Extended Valve Stems: On insulated valves.

I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

J. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

- a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

K. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

A. Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

- a. Conbraco Industries, Inc.; Apollo Div.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. DynaQuip Controls.
- f. Flow-Tek, Inc.
- g. Grinnell Corporation.
- h. Hammond Valve.
- i. Honeywell Braukmann.
- j. Jamesbury, Inc.
- k. Jomar International, LTD.
- l. Kitz Corporation of America.
- m. Legend Valve & Fitting, Inc.
- n. Milwaukee Valve Company.
- o. Nexus Valve Specialties.
- p. NIBCO INC.
- q. R & M Energy Systems (Borger, TX).
- r. Red-White Valve Corp.
- s. Richards Industries; Marwin Ball Valves.
- t. Watts Industries, Inc.; Water Products Div.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

- C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with regular port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

2.4 BRONZE CHECK VALVES

A. Manufacturers:

- 1. Type 2, Bronze, Lift Check Valves with Nonmetallic Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Div.
 - d. Red-White Valve Corp.
 - e. Walworth Co.
- 2. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:
 - a. American Valve, Inc.
 - b. Cincinnati Valve Co.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Div.
 - f. Grinnell Corporation.
 - g. Hammond Valve.
 - h. Kitz Corporation of America.
 - i. Legend Valve & Fitting, Inc.
 - j. Milwaukee Valve Company.
 - k. NIBCO INC.
 - l. Powell, Wm. Co.
 - m. Red-White Valve Corp.
 - n. Walworth Co.
 - o. Watts Industries, Inc.; Water Products Div.

B. Bronze Check Valves, General: MSS SP-80.

- C. Type 2, Class 125, Bronze, Lift Check Valves: Bronze body and seat, with nonmetallic disc.
- D. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body and seat, with nonmetallic disc.

2.5 CAST-IRON GATE VALVES

A. Manufacturers:

- 1. Type I, Cast-Iron, Rising-Stem Gate Valves:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.

- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation
- f. Hammond Valve
- g. Kitz Corporation of America
- h. Legend Valve & Fitting, Inc.
- i. Milwaukee Valve Company
- j. NIBCO Inc.
- k. Powell, Wm. Co.
- l. Red-White Valve Corp.
- m. Walworth Co.
- n. Watts Industries, Inc.; Water Products Div.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I

C. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

2.6 CHAINWHEEL ACTUATORS

A. Available Manufacturers:

B. Manufacturers:

- 1. Babbit Steam Specialty Co.
- 2. Roto Hammer Industries, Inc.

C. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

- 1. Sprocket Rim with Chain Guides: Cast iron of type and size required for valve.
- 2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
- 3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

2.7 CPVC BALL VALVES

A. Manufacturers:

- 1. CPVC True Union Ball Valves:
 - a. American Valve, Inc.
 - b. Harvel Plastics, Inc.
 - c. NIBCO, Inc.
 - d. Tomlinson Industries
 - e. Watts Industries, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or gate valves.
 - 2. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. Domestic Water Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2" and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
 - 2. CPVC True Union Ball Valves.
 - 3. Swing Check Valves, NPS 2" and Smaller: Type 4, Class 125 bronze.
 - 4. Swing Check Valves, NPS 2-1/2 and larger: Type II, Class 125, gray iron
 - 5. Gate Valves, NPS 2-1/2 and larger: Type I, Class 125 OS&Y, bronze-mounted cast iron.
- C. Sanitary Waste Piping: Use the following types of valves:
 - 1. Swing Check Valves, NPS 2 and smaller: Type 3, Class 125, bronze.
 - 2. Gate Valves, NPS 2 and smaller: Type 1, Class 125, bronze.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: IN horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS

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 hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
 - 2. Division 13 Sections on fire-suppression piping for fire-suppression pipe hangers.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - l. Piping Technology & Products, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.
 - c. GS Metals Corp.
 - d. Michigan Hanger Co., Inc.; O-Strut Div.
 - e. National Pipe Hanger Corp.
 - f. Thomas & Betts Corp.
 - g. Unistrut Corp.
 - h. Wesanco, Inc.
 - 3. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.
 - e. Rilco Manufacturing Co., Inc.
 - f. Value Engineered Products, Inc.
 - 4. Powder-Actuated Fastener Systems:

- a. Gunnebo Fastening Corp.
- b. Hilti, Inc.
- c. ITW Ramset/Red Head.
- d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.
 - 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
 - 3. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
 - 5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
 - 6. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
 - 7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 - 8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
 - 9. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipe, 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 two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 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.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification 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.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification 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.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. 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 head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support 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. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
 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 D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

- E. Install powder-actuated drive-pin fasteners 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.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. 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 B31.9.
 - 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 arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

- d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
- e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood 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 above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching 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 a minimum dry film thickness of 2.0 mils.

Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 220578 - PLUMBING SPECIALTIES

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 plumbing specialties:
 - 1. Backflow preventers.
 - 2. Strainers.
 - 3. Hose stations.
 - 4. Key-operation hydrants.
 - 5. Trap seal primer valves.
 - 6. Drain valves.
 - 7. Miscellaneous piping specialties.
 - 8. Sleeve penetration systems.
 - 9. Flashing materials.
 - 10. Cleanouts.
 - 11. Floor drains and floor receptors.
 - 12. Roof drains.
 - 13. Grease interceptors.
- B. Related Sections include the following:
 - 1. Division 15 Section "Meters and Gages" for water meters, thermometers, and pressure gages.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PUR: Polyurethane plastic.
 - 4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Piping: 125 psig.
 - 2. Sanitary Waste and Vent Piping: 10-foot head of water.
 - 3. Storm Drainage Piping: 10-foot head of water.

4. Force-Main Piping: 100 psig.

1.5 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
 1. Backflow preventers.
 2. Water hammer arresters, air vents, and trap seal primer valves.
 3. Drain valves, hose bibbs, hydrants, and hose stations.
 4. Cleanouts, floor drains, floor receptors, and roof drains.
 5. Vent caps, vent terminals, and roof flashing assemblies.
 6. Grease interceptors.
 7. Sleeve penetration systems.
- B. Field test reports.
- C. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
 1. Backflow preventers.
 2. Trap seal primer valves and systems.
 3. Hose stations and hydrants.
 4. Grease interceptors.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. 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.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for drain, waste, and vent piping components. Include marking "NSF-DWV" on plastic drain, waste, and vent piping.
 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Operating Key Handles: Furnish one key for each key-operated hose bibb and hydrant installed.
 - 2. Hose: Manufacturer's standard for service fluid, temperature and pressure 50 feet (15M) long: furnish six hoses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Ames Co., Inc.
 - 2. B & K Industries, Inc.
 - 3. Cla-Val Co.
 - 4. CMB Industries, Inc.; Febco Backflow Preventers.
 - 5. Conbraco Industries, Inc.
 - 6. FLOMATIC Corp.
 - 7. IMI Cash Valve.
 - 8. Mueller Co.; Hersey Meters Div.
 - 9. Sparco, Inc.
 - 10. Watts Industries, Inc.; Water Products Div.
 - 11. Zurn Industries, Inc.; Wilkins Div.
- B. General: ASSE standard, backflow preventers.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - 2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
 4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
 5. Strainer: On inlet, if indicated.
- C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.
- D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.
- E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.
- F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.
1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
- G. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.
1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- H. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.
1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, NPS 3/8.
- J. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.
- K. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 STRAINERS

- A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.
 - 1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
 - 2. NPS 2 and Smaller: Bronze body, with female threaded ends.
 - 3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
 - 4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
 - a. Drain: Factory- or field-installed, hose-end drain valve.

2.4 HOSE STATIONS

- A. Manufacturers:
 - 1. Armstrong-Lynnwood, Inc.
 - 2. Cooney Brothers, Inc.; Hose Station Div.
 - 3. Leonard Valve Company.
 - 4. Penberthy, Inc.
 - 5. Strahman Valves, Inc.
 - 6. T & S Brass and Bronze Works, Inc.
- B. General: Assembly with fitting complying with ASME A112.18.1M and hose-connection outlet with threads complying with ASME B1.20.7.

2.5 KEY-OPERATION HYDRANTS

- A. Manufacturers:
 - 1. Josam Co.
 - 2. Murdock, Inc.
 - 3. Simmons Manufacturing Co.
 - 4. Smith, Jay R. Mfg. Co.
 - 5. Tyler Pipe; Wade Div.
 - 6. Watts Industries, Inc.; Drainage Products Div.
 - 7. Woodford Manufacturing Co.
 - 8. Zurn Industries, Inc.; Jonespec Div.
 - 9. Zurn Industries, Inc.; Specification Drainage Operation.
- B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.
 - 1. Inlet: NPS 3/4 threaded or solder joint.
 - 2. Outlet: ASME B1.20.7, garden-hose threads.
 - 3. Operating Keys: One with each key-operation hydrant.

- C. Nonfreeze Exposed-Outlet Wall Hydrants: ASSE 1019, self-drainable with integral nonremovable hose-connection vacuum breaker, casing and operating rod to match wall thickness, projecting outlet, and wall clamp.

- 1. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
- 2. Nozzle and Wall Plate Finish: Polished nickel bronze.

2.6 TRAP SEAL PRIMER VALVES

- A. Trap Seal Primer Valves: ASSE1018 water supply-fed type with the following:

- 1. Manufacturers:
 - a. Precision Plumbing Products, Inc.
 - b. MIFAB Manufacturing, Inc.
 - c. Smith, Jay R Manufacturing Co.
- 2. 125 psig minimum working pressure.
- 3. Bronze body with atmospheric-vented drain chamber.
- 4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
- 5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
- 6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.7 DRAIN VALVES

- A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
 - 1. Inlet: Threaded or solder joint.
 - 2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.
- B. Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.
- C. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.8 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers:
 - a. Amtrol, Inc.
 - b. Josam Co.
 - c. Precision Plumbing Products, Inc.
 - d. Sioux Chief Manufacturing Co., Inc.
 - e. Watts Industries, Inc.; Drainage Products Div.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- B. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
 1. Finish for Equipment Rooms: Rough bronze.
 2. Finish for Service Areas: Rough bronze.
 3. Operation for Equipment Rooms: Wheel handle.
 4. Operation for Service Areas: Wheel handle.
- C. Air Vents: Float type for automatic air venting.
 1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 1/2 minimum inlet; 125-psig minimum pressure rating at 140 deg F; and threaded vent outlet.
 2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 minimum inlet, 150-psig minimum pressure rating, and threaded vent outlet.
- D. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.
 1. Manufacturers:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 2. Open-Top Vent Cap: Without cap.
 3. Wall Vent Cap: With vandal-proof vent cap.
 4. Extended Vent Cap: With field-installed, vandal-proof vent cap.
- E. Open Drains: 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.
- F. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- G. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or

threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

- H. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
- I. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.
- J. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.
- K. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.9 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:

- 1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

- 1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
- 2. Stack Fitting: ASTM A 48, gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
 - a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.10 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-lb/sq. ft., 0.0625-inch thickness.
- 2. Vent Pipe Flashing: 3-lb/sq.ft., 0.0469-inch thickness.
- 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152, of the following minimum weights and thicknesses, unless otherwise indicated:

- 1. General Applications: 12 oz./sq.ft.
- 2. Vent Pipe Flashing: 8 oz./sq.ft.

- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.11 CLEANOUTS, FLOOR DRAINS, ROOF DRAINS

- A. Cleanouts, Comply with ASME. See "DRAIN SCHEDULE" on plans.
 - 1. Products:
 - a. Josam Co.
 - b. Smith, Jay R. Mfg. Co.
 - c. Tyler Pipe, Wade Div.
 - d. Watts Industries, Inc., Drainage Products Div.
 - e. Zurn Industries, Inc., Specification Drainage Operation.

2.12 GREASE INTERCEPTORS

- A. Grease Interceptors, Reinforced precast concrete per ASTM Non-Traffic interceptor.
 - 1. Products:
 - a. Mack Industries, Inc.
 - b. EC Babbert, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install strainers on supply side of each control valve.
- D. Install 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.
- E. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- F. 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 100 feet for piping NPS 4 and for larger piping.
 4. Locate at base of each vertical soil and waste stack and storm conductor.
- G. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- H. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- I. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- J. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- K. Install frost-proof vent caps on each vent pipe passing through wall. Maintain 1-inch clearance between vent pipe and roof substrate.
- L. 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.
- M. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
- N. Install grease interceptors, including piping, according to authorities having jurisdiction and with clear space for servicing.
- O. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- P. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- Q. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- R. Install individual shutoff valve in each water supply to plumbing specialties. Use ball or gate valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- S. Install air vents at piping high points. Include ball or gate valve in inlet and drain piping from outlet to floor drain.
- T. Install traps on plumbing specialty drain outlets.
- U. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

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 equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 15 Sections.
- D. Ground equipment.

- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 16 Sections.

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-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve trap seal primer system.
 - 1. Text: 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.
 - 2. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for nameplates and signs.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain plumbing specialties. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 220578

SECTION 220719 – PLUMBING PIPING INSULATION

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 preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Section 220529 – 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. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. 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 75 or less, and smoke-developed rating of 150 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 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems. 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, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. Johns Manville Corp.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

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, 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.
1. Adhesive: As recommended by insulation material manufacturer.
 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. 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.

2.4 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. 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.
- G. 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.
 - 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.
- H. 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.
- I. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- J. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- K. Fire-Rated 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."

- L. 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 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. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 - 3. Cover fittings with standard PVC fitting covers.
- C. 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. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. 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. Use preformed heavy 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.
 - 6. 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 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.

3.6 FINISHES

- A. Flexible elastomeric Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

3.7 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. Fire-suppression piping.
 - 4. Drainage piping located in crawl spaces, unless otherwise indicated.
 - 5. Below-grade piping, unless otherwise indicated.
 - 6. Chrome-plated pipes and fittings, unless potential for personnel injury.
 - 7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.8 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.9 INSULATION APPLICATION SCHEDULE

- A. Service: Domestic (potable) cold, non-potable water.
 - 1. Operating Temperature: 40 to 100 deg F.
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: 1/2 inch.
 - 4. Jacket: Foil and paper.

5. Vapor Retarder Required: Yes.
 6. Finish: None.
- B. Service: Domestic hot and recirculated hot water.
1. Operating Temperature: 40 to 140 deg F.
 2. Insulation Material: Mineral fiber.
 3. Insulation Thickness: 1 inch.
 4. Jacket: Foil and paper.
 5. Vapor Retarder Required: Yes.
 6. Finish: None.
- C. Service: Horizontal Stormwater Piping and Roofdrain Bodies.
1. Operating Temperature: 32 to 100 deg F.
 2. Insulation Material: Mineral fiber.
 3. Insulation Thickness: 1/2 inch.
 4. Jacket: Foil and paper.
 5. Vapor Retarder Required: No.
 6. Finish: None.
- D. Service: Refrigerant Suction Piping.
1. Operating Temperature: 35 to 50 deg F.
 2. Insulation Material: Flexible Elastomeric.
 3. Insulation Thickness: 1/2 inch.
 4. Jacket: None.
 5. Vapor Retarder Required: No.
 6. Finish: Painted.
- E. Service: Heating Hot-Water Supply and Return.
1. Operating Temperature: 100 to 200 deg F.
 2. Insulation Material: Mineral Fiber.
 3. Insulation Thickness: 1 inch.
 4. Jacket: Foil and Paper.
 5. Vapor Retarder Required: No.
 6. Finish: None.
- F. Service: Condensate drain piping.
1. Operating Temperature: 35 to 75 deg F.
 2. Insulation Material: Flexible elastomeric.
 3. Insulation Thickness: 1/2 inches.
 4. Jacket: None
 5. Vapor Retarder Required: No.
 6. Finish: Painted.

G. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.

1. See "Plumbing Fixture Schedules" on the plans.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.
- B. Related Sections include the following:
 - 1. Section 220519 – Meters and Gages for thermometers, pressure gages, & fittings.
 - 2. Section 220578 – Plumbing Specialties for water distribution piping specialties.
 - 3. Section 330531.16 – PVC Pipe (AWWA C900)
 - 4. Section 330533.23 – HDPE Pipe (AWWA C901)

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.
 - 2. Domestic Water Distribution Piping: 125 psig.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in "Cleaning" Article in Part 3.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 DUCTILE-IRON PIPING

- A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern.
 - a. Gaskets: AWWA C111, rubber.
 - 2. Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed, ball-joint sections and one or more gasketed, sleeve section. Assemble components for offset and expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
 - 3. Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
 - 4. Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

2.3 COPPER TUBING

- A. Soft Copper Tube: ASTM B 88, Types K, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, flared fittings. Furnish wrought-copper fittings if indicated.
- B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint or crimped fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint or crimped ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint, crimped, or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

2.4 CPVC PIPING

- A. CPVC Schedule 80 Pipe: ASTM F 441/F 441M.
 1. CPVC Schedule 80 Fittings: ASTM F 439, socket.
- B. CPVC Piping System: ASTM 2846/D 2846/M, SDR 11, pipe and socket fittings.

2.5 VALVES

- A. Refer to Division 22 Section "Valves" for bronze and cast-iron, general-duty valves.
- B. Refer to Division 22 Section "Plumbing Specialties" for balancing and drain valves.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: Crimped joints may be used on aboveground copper tubing.
- D. Underground Domestic Water and Water Service Piping: Use the following piping materials for each size range:
 1. NPS 2" and Smaller: HDPE Pipe. See Section 330533.23.
 2. NPS 3" and Above: PVC Pipe. See Section 330531.16.
- E. Aboveground Domestic Water Piping: Use the following piping materials for all sizes:
 1. Hard copper tube, Type L; copper pressure fittings; and soldered or crimped joints.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball for piping NPS 2 and smaller. Use cast-iron gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 3. Drain Duty: Hose-end drain valves.

3.4 PIPING INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- C. Install underground ductile-iron piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- D. Install underground copper tubing according to CDA's "Copper Tube Handbook."
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- F. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service. Refer to Division 15 Section "Meters and Gages" for pressure gages, and to Division 15 Section "Plumbing Specialties" for drain valves and strainers.
- G. Install aboveground domestic water piping with 0.25 percent slope downward toward drain.
- H. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- I. Perform the following steps before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.

- 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
- J. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- K. Check plumbing specialties and verify proper settings, adjustments, and operation.
 - 1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.
- L. Energize pumps and verify proper operation.

3.5 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.6 VALVE INSTALLATION

- A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment.
- B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops.
- 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.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to proposed equipment and fixtures.

3.8 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. 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:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping 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 domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

- 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221316 - STORM, SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes soil and waste, sanitary and storm drainage and vent piping inside the building and to locations indicated.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Sanitary Sewer, Force-Main Piping: 50 psig.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

- A. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
 - a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
 - 1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.

2.3 PVC PIPING

- A. Solid Wall PVC Pipe: ASTM D2665, Drain, Waste and Vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns and to fit pipe.

2.4 CONCRETE ENCASEMENT

- A. Concrete Encasement for Underground PVC Force Main Piping: 3000 psi concrete.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Aboveground Storm, Soil, Waste, and Vent Piping Exposed or in Chases: Use the following piping materials for all sizes:
 - 1. Solid wall, Schedule 40, PVC pipe: ASTM D2665 DWV, PVC socket fittings and solvent-cemented joints.
- C. Aboveground Storm, Soil, Waste, and Vent Piping in Air Plenums: Use the following piping materials for all sizes:
 - 1. Hubless, cast-iron soil piping with the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.
- D. Underground Storm, Soil, Waste and Vent Piping: Use the following piping materials for all sizes:
 - 1. Solid Wall, Schedule 40, PVC Pipe: ASTM D2665, DWV; PVC socket fittings and solvent-cemented joints.
- E. Sanitary-Sewage Force Mains: Use the following piping materials for all sizes:
 - 1. Solid wall, Schedule 80, PVC pipe: ASTM D2665, DWV; PVC socket fittings and solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Refer to Division 33 Sections for Project-site sanitary and storm sewer piping.
- B. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- F. 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."

- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. 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.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Install force mains at elevations indicated.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- N. Provide concrete encasement for underground PVC force mains as indicated on the plans.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

- A. Refer to Division 22 Section "Valves" for general-duty valves.
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use full-port ball valve for piping NPS 2 and smaller.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 - 6. NPS 15: 60 inches with 1-inch rod.
 - 7. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for 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: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

H. Install supports for vertical PVC piping every 48 inches.

I. 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 storm, soil and waste piping to exterior sanitary and storm 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. Refer to Division 22 Section "Plumbing Fixtures."
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. Refer to Division 15 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior sanitary manhole.
2. Sewage Pumps: To sewage pump discharge.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary and storm 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.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 4. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

SECTION 224000 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
 - 2. Division 22 Section "Valves" for general-duty valves used as supply stops.
 - 3. Division 22 Section "Plumbing Specialties" for backflow preventers and other specialties not specified in this Section.

1.3 DEFINITIONS

- A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- C. Wiring diagrams from manufacturer for electrically operated units.

- D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.
 - 1. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.
- B. Regulatory Requirements: Comply with requirements of CABO A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; regarding plumbing fixtures for physically handicapped people.
- C. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- E. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing fixtures and are based on specific types and models indicated. Other manufacturers' fixtures with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Lavatories, Urinals, Water Closets:

- a. American Standard
- b. Crane
- c. Eljer
- d. Kohler

2. Mop Basins:

- a. Fiat
- b. Mustee
- c. Stern-Williams

3. Sump and Sewage Pumps:

- a. Aurora
- b. Hydromatic
- c. Paco
- d. Weil
- e. Weinman
- f. Zoeller

4. Emergency Fixtures:

- a. Haws
- b. Bradley
- c. Guardian

2.2 PLUMBING FIXTURE STANDARDS

A. Comply with applicable standards below and other requirements specified.

1. National Sanitation Foundation Construction: NSF 2.

2. Vitreous-China Fixtures: ASME A112.19.2M.
3. Water-Closet, Flush Valve: ASME A112.19.5.

2.3 LAVATORY/SINK FAUCET STANDARDS

- A. Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; 2.2-gpm-maximum flow rate; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
 1. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 2. Faucet Hose: ASTM D 3901.
 3. Hose-Connection Vacuum Breakers: ASSE 1011.
 4. Hose-Coupling Threads: ASME B1.20.7.
 5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 6. Pipe Threads: ASME B1.20.1.
 7. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 8. Sink Spray Hoses: ASTM D 3573.

2.4 MISCELLANEOUS FITTING STANDARDS

- A. Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.
 1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Automatic Flow Restrictors: ASSE 1028.
 3. Brass and Copper, Supplies and Tubular Brass: ASME A112.18.1M.
 4. Fixed Flow Restrictors: ASSE 1034.
 5. Manual-Operation Flushometers: ASSE 1037.
 6. Plastic Tubular Fittings: ASTM F 409.

2.5 MISCELLANEOUS COMPONENT STANDARDS

- A. Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.

1. Floor Drains: ASME A112.21.1M.
2. Hose-Coupling Threads: ASME B1.20.7.
3. Pipe Threads: ASME B1.20.1.
4. Plastic Toilet Seats: ANSI Z124.5.
5. Supply and Drain Insulation Kits: CABO A117.1.
6. Supports: ASME A112.6.1M.

2.6 FITTINGS

- A. Fittings for Plumbing Fixtures: Refer to plumbing fixture schedules on plans for materials for supplies, supply stops, supply risers, traps, and other fittings.
- B. Fittings for Equipment Specified in Other Sections: Fittings include the following:
 1. Supply Inlets: Brass pipe or copper tube, size required for final connection.
 2. Supply Stops: Chrome-plated brass, angle or straight; compression, wheel-handle type; same size as supply inlet and with outlet matching supply riser.
 3. Supply Risers: 1/2-inch NPS flexible copper tube with knob end. Use chrome-plated tube for exposed applications.
 4. Traps: Cast brass with slip-joint inlet, cleanout pipe nipple to wall, wall flange, escutcheons, and size to match equipment. Use chrome-plated tube for exposed applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Include supports for plumbing fixtures according to the following:
 - 1. Carriers: For wall-hanging water closets and fixtures supported from wall construction.
 - 2. Chair Carriers: For wall-hanging urinals, lavatories, sinks, drinking fountains, and electric water coolers.
 - 3. Heavy-Duty Chair Carriers: For accessible urinals, lavatories, and other fixtures where indicated.
 - 4. Reinforcement: For floor-mounted lavatories and sinks that require securing to wall and recessed, box-mounted, electric water coolers.
 - 5. Fabricate reinforcement from 2-by-4-inch or 2-by-6-inch fire-retardant-treated-wood blocking between studs or 1/4-by-6-inch steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.
- B. Include fitting insulation kits for accessible fixtures according to the following:
 - 1. Lavatories: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.

3.3 PLUMBING FIXTURE INSTALLATION

- A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.
- B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.
- C. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.
- D. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.
- E. Install toilet seats on water closets.
- F. Install wall-hanging, back-outlet urinals with gasket seals.
- G. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.

- H. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.
- I. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.
- J. Fasten recessed, wall-mounted fittings to reinforcement built into walls.
- K. Fasten wall-mounted fittings to reinforcement built into walls.
- L. Secure supplies to supports or substrate within pipe space behind fixture.
- M. Set mop basins in leveling bed of cement grout.
- N. Install individual stop valve in each water supply to fixture, in accessible location. Use gate or ball valve where specific stop valve is not specified.
- O. Install supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.
- Q. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.
- R. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.
- S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealants." Match sealant color to fixture color.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
 - 1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 15 Sections.

- B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.
- C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.
- D. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 16 Sections.

3.5 FIELD QUALITY CONTROL

- A. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- B. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- C. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.6 ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

2. Remove sediment and debris from drains.

3.7 FIXTURE SCHEDULES

- A. See plans for "Plumbing Fixture Schedules."

END OF SECTION 224000

SECTION 224239 - POST HYDRANTS

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly set in place, all post hydrants, gravel drain pits, copper pipe and anchors, together with wrenches and keys for the proper completion of the work included under this contract.
- B. In general, this work includes the connecting up to the water main, installing gravel drain pit, necessary copper pipe and post hydrant as herein specified plus concrete anchor or other thrust restraint as directed by the Engineer.
- C. It is the intent of this contract that the final installation shall be complete in all respects and the Contractor shall be responsible for minor details and any necessary special construction not specifically included in the Drawings or Specifications.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 WORKMANSHIP

- A. All work shall be installed in strict accordance with the requirements, codes and ordinances of the Owner and shall meet the inspection of same. Workmanship shall be first class in every respect and all work shall be carried out by persons who are thoroughly experienced in this line of work.

1.5 SUBMITTALS

- A. The Contractor shall submit detail drawings, drawn to scale, catalog data, three (3) copies of head loss charts and cuts of all equipment he proposes to furnish.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Post hydrants shall have a bury depth of not less than 4'-0".
- B. Post hydrants shall be of the anti-freezing type with operating valves buried below the frost line which are easily removable without digging up the hydrant.
- C. The post hydrant casing shall be bronze or aluminum.
- D. The post hydrant shall be supplied with a wheel handle, T-handle or cast steel lever handle. No pedal-operated or self-closing hydrant will be permitted.
- E. Outlet and inlet connections shall be of the same size as the post hydrant supplied.
- F. Each post hydrant shall be stenciled with the words "Unsafe Water - Do Not Drink". The size of the stenciled letters shall be 1 inch. Stencil on the hydrants is to be on the nozzle section.

PART 3 - EXECUTION

3.1 INSTALLING HYDRANTS

- A. Post hydrants shall be installed where shown on the plans or as directed by the Engineer. The completed installation shall be completely accessible and shall be such that the possibility of damage from vehicles or injury to pedestrians will be minimized.
- B. All post hydrants shall be installed plumb. Post hydrants shall be set according to the contract drawings.
- C. Each post hydrant shall be connected to the main with a branch connection of the same size as the post hydrant inlet.
- D. A drainage pit shall be excavated at each post hydrant and filled with coarse gravel or crushed stone, mixed with coarse sand, compacted in place under and around the elbow of the post hydrant as illustrated on the drawings. No drainage pit shall be connected to a sewer.

3.2 CLEANING AND PAINTING

- A. The post hydrant shall be painted in accordance with Section 099700.
- B. Post hydrants shall be painted dark blue.

3.3 HYDROSTATIC TEST

- A. Each post hydrant shall be tested at the shop by hydraulic pressure.
- B. The criteria for testing the approved post hydrants shall conform to the requirements of the Owner with regards to pressures and length of tests.
- C. Any post hydrant found defective shall be rejected.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M manuals shall be in compliance with the General Requirements.

END OF SECTION 224239

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

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 TAB to produce design objectives for the following:

- 1. Air Systems:
 - a. Constant-air-volume systems.
- 2. Hydronic Piping Systems:
 - a. Variable-flow systems.
- 3. Verifying that automatic control devices are functioning properly.
- 4. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. TAB: Testing, adjusting, and balancing.

1.4 SUBMITTALS

- A. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. TAB Report Forms: Use standard forms from 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."

1.6 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. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. 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.
- E. 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.
- F. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 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" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 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.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

3.5 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.6 PROCEDURES FOR MOTORS

- A. 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.
- B. 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.

3.7 PROCEDURES FOR BOILERS

- A. If hydronic, measure entering- and leaving-water temperatures and water flow.

3.8 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.

3.9 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- C. Check free travel and proper operation of control devices such as damper and valve operators.
- D. 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.
- E. Note operation of electric actuators using spring return for proper fail-safe operations.

3.10 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.

3.11 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. 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:
 - 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.
 - 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.
- D. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
- a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model and serial numbers.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

E. Boiler Test Reports:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Service.
- d. Make and type.
- e. Model and serial numbers.
- f. Fuel type and input in Btuh.
- g. Number of passes.
- h. Ignition type.
- i. Burner-control types.
- j. Voltage at each connection.
- k. Amperage for each phase.

2. Test Data (Indicated and Actual Values):

- a. Operating pressure in psig.
- b. Operating temperature in deg F.
- c. Entering-water temperature in deg F.
- d. Leaving-water temperature in deg F.
- e. Number of safety valves and sizes in NPS.
- f. Safety valve settings in psig.
- g. High-limit setting in psig.
- h. Operating-control setting.
- i. High-fire set point.
- j. Low-fire set point.
- k. Voltage at each connection.
- l. Amperage for each phase.
- m. Manifold pressure in psig.

3.12 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 238316 – RADIANT HEAT HYDRONIC PIPING

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. Hydronic radiant heating systems using PEX tubing in slab, and as distribution piping with insulation.
- B. The work described in this section includes, but is not limited to, the following:
 - 1. Complete hydronic radiant heating system including tubing, manifolds, fittings, tubing, installation systems, fasteners and controls.
 - 2. Circulation pumps and distribution piping.
 - 3. Condensing high efficiency gas boiler.
 - 4. System controls and automation.
 - 5. System commissioning and startup service.
- C. Related Sections: The following sections, though not exhaustive, may have an impact on installation of the hydronic radiant heating system:
 - 1. Section 033000 – Cast in Place Concrete
 - 2. Section 072100 – Building Insulation

1.3 REFERENCES

- A. Abbreviations and Acronyms
 - 1. PEX – Crosslinked polyethylene
 - 2. PEX-a – PEX tubing using the “hot” cross-linking method
 - 3. EVOH – Ethyl Vinyl Alcohol (oxygen barrier compound)
 - 4. SDR 9 - Standard Dimension Ratio. SDR is the ratio of pipe diameter to wall thickness. SDR 9 – Outside diameter of pipe is 9x wall thickness of pipe.
- B. Reference Standards
 - 1. ASTM – American Society for Testing and Materials
 - a. ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing
 - b. ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold-Water Distribution Systems
 - c. ASTM 1807-11ae1 Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing

- d. ASTM F2098-08 Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings
 - e. ASTM F2165 Standard Specification for Flexible Pre-Insulated Piping
 - 2. DIN – German Institute for Standardization
 - a. DIN 4726 Pipelines of Plastic Materials Used in Warm Water Floor Heating Systems; General Requirements
 - b. DIN 16892 Cross-linked Polyethylene Pipes – General Quality Requirements and Testing
 - c. DIN 16893 Cross-linked Polyethylene Pipes - Dimensions
 - 3. PPI – Plastic Pipe Institute
 - a. PPI TR-3 Policies and Procedures for Developing Hydrostatic Design (SDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe
 - b. PPI TR-4 Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Piping and Fitting Compounds

1.4 SUBMITTALS

- A. The following information shall be submitted to the Engineer in accordance with Section 013323 – Shop Drawings, Product Data and Samples. Copies of all materials required to establish compliance with this Section. Submittals shall include the following:
- B. Product Data: Submit manufacturer's technical data and application instructions.
 - 1. Submit manufacturer's product submittal forms, brochures, technical data sheets, catalog pages and installation manuals for each product listed in this section.
 - 2. Submit data in sufficient detail to indicate compliance with the contract documents.
- C. Shop Drawings
 - 1. Submit detailed design report including room by room heat load data, design temperature, maximum supply temperature, total flow rate, maximum head loss, zone plan, manifold summary including zone name, zone area, indoor air temperature requirement, installation type, tubing size and spacing, loop lengths, manifold and loop flow rates, head losses and supply temperatures, balance valve settings.
 - 2. Submit installation drawings indicating tubing layout, manifold locations, distribution piping and zoning requirements.
 - 3. Submit drawings showing details of manifold installation. If manifolds are installed on a wall, then the details should include all fastening details. If the manifolds are installed in wall cavities, then provide details on all fasteners and access. If manifolds are to be placed in manifold cabinets, then provide details of fastening cabinets to walls, floors or wall cavities.
 - 4. Submit detailed piping schematic including heat source, piping, valves, pumps, mixing devices, oxygen removal devices, expansion tanks, gauges, circuit setters, etc. Indicate type and size where necessary.
 - 5. Provide sectional drawings indicating tubing and accessory installation method(s). i.e. in-slab, in-joist, above floor sleeper, radiant panels.

- D. Certificates:
 - 1. Submit contractor(s) certification statement(s) that the hydronic radiant system has been installed in accordance with this specification.
- E. Closeout:
 - 1. Maintenance Contracts:
 - a. Submit maintenance contract for system or any part in the system, as required.
 - 2. Operation and Maintenance Data:
 - a. Provide operational and maintenance data, as required.
 - b. Final as-built tubing layout drawing.
 - 3. Warranty Documentation:
 - a. Submit final executed warranty document for system.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer:
 - a. Manufacturer shall have a minimum of ten years' experience in similar systems.
 - b. Manufacturer shall provide products of consistent quality in appearance and physical properties.
 - 2. Installers:
 - a. Installers shall have demonstrated experience on projects of similar size and complexity and/or documentation proving successful completion of system training hosted/approved by the system manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery:
 - 1. Deliver materials in original, unopened, undamaged containers or packaging with manufacturer identification labels intact.
- B. Storage:
 - 1. Store materials in dry, enclosed, well-ventilated area protected from exposure to harmful environmental conditions.
 - 2. PEX tubing and manifold openings shall be covered or capped to prevent contaminants from entering.
 - 3. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.
- C. Handling:
 - 1. PEX tubing shall be kept away from sharp objects and not be handled in a way as to cause damage and/or puncture.
 - 2. Protect materials from damage by other trades.

1.7 WARRANTY

A. Manufacturer's Warranty:

1. Provide manufacturer's standard warranty document.
 - a. PEX tubing shall be under warranty for a period of twenty-five (25) years, non-prorated, against failure due to defect in material or workmanship beginning with successful pressurized water tests immediately following system installation.
 - b. Manifolds and fittings shall be under warranty for a period of two (2) years, non-prorated, against failure due to defect in material or workmanship beginning with successful pressurized water tests immediately following system installation.
 - c. Electrical and control parts shall be under warranty for a period of two (2) years, non-prorated, against failure due to defect in material or workmanship beginning with successful pressurized water tests immediately following system installation.
2. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Owner may have under contract documents.

PART 2 - PRODUCTS

2.1 CONDENSING HIGH EFFICIENCY GAS BOILERS (Total of 2)

- A. Model: Lochinvar Fire Tube Boiler Model # KHB-155N, or approved equal.
 1. As represented by Campbell Equipment Company, 6941 McNerney Drive, Northwood OH, 43619, 419-874-5970.
- B. Fuel: Natural Gas
- C. Heating Capacity: 144 MBH
- D. AFUE: 95%

2.2 SYSTEM MATERIALS:

A. Service Tubing:

1. All tubing shall be cross-linked polyethylene (PEX) manufactured by PEX-a method
2. Tubing shall conform to ASTM F876, ASTM F877 and CSA B137.5.
3. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa at 82°C) and 80 psi gauge pressure at 200°F (550 kPa at 93°C).
4. EVOH layer shall be capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/(m²/d) @ 104°F (40°C) water temperature, in accordance with DIN 4726.
5. The minimum bend radius of the tubing shall be no less than six (6) times the outside diameter. Bends with a smaller radius shall require the use of manufacturer supplied metal bend supports.

6. Acceptable Manufacturer: HeatLink Group Inc., 4603E – 13th Street NE, Calgary, AB, Canada. Phone (800) 323-1545, Fax (888) 800-8114, Website: www.heatlink.com, or approved equal.

B. Pre-Insulated Piping

1. For underground connection & distribution between multiple slabs.
2. Interior Piping shall be PEX-a service tubing as specified in previous section – 2.2.A, with Insulation and Outer Jacket as specified below.
3. Outer Jacket
 - a. Material is corrugated seamless high-density polyethylene (HDPE)
 - b. The HDPE jacket completely encompasses and protects the insulation from moisture and damage.
 - c. The outer jacket shall be cast with a corrugated pattern along its entire length. The corrugation pattern shall provide flexibility in the longitudinal direction and rigidity against radial forces.
 - d. The corrugation shall employ a double walled closed cell construction to provide an extra layer of protection from piercing of the outer jacket.
 - e. Single wall exterior jackets shall be deemed not equal for the long-term protection of the Owner.
 - f. The outer jacket shall contain two percent carbon black to provide protection from UV degradation.
 - g. Minimum Bend Radius shall conform to DIN 16892
4. Insulation:
 - a. The insulation shall be cross-linked polyethylene closed cell foam with a water absorption after 28 days of less than 1.04 percent.
 - b. All seams of the insulation shall be sealed.
 - c. Insulation shall not be bonded to the service tubing.
 - d. Insulation shall not crush, break or pulverize.
5. Acceptable Manufacturer: Watts Radiant, Inc. (Subsidiary of Watts Water Technologies, Inc.) 4500 E. Progress Place, Springfield, MO 65803. Phone: (800) 276-2419, (417) 864-6108; Fax: (417) 864-8161. Website: www.wattsradiant.com, or approved equal.

C. Manifolds

1. Stainless Steel manifold sets:
 - a. A manifold set shall consist of one supply and one return manifold preassembled onto a mounting bracket.
 - b. Manifold sets shall contain visual flow gauge with built in flow adjustment and stop valves, integral valve assemblies for loop isolation and for mounting thermostat controlled valve actuators, manual air vent/fill valve and isolation valves on supply and return.
 - c. Manifold sets shall have the following ratings:
 - 1) Maximum trunk flow rate – 18gpm (4.1m³/h)
 - 2) Maximum circuit flow rate – 2.5pm (0.57m³/h)
 - 3) Maximum operating temperature - 230°F (110°C) continuous
 - 4) Maximum operating pressure – 100 psi (6.9 bar) continuous
 - d. Manifold fittings shall be R20 (nominal 3/4") threaded brass compression fittings.
 - e. Manifold sets shall accommodate 1/2" and 5/8" PEX-a tubing.

2. Manifolds shall be supplied by same manufacturer of PEX tubing, as specified in section 2.2.A – 6.
- D. End Seals
1. The piping manufacturer will supply all end caps.
 2. End caps are to be installed on each end prior to connecting the service pipes and insulating the field joints.
 3. Where necessary, the end caps will heat shrink onto the piping outer jacket forming a watertight seal.
- E. Fittings:
- a. For system compatibility, use fittings offered by the PEX-a manufacturer.
 - b. Fittings will consist of compression fitting with a coupling sleeve, a fitting
 - c. body insert with o-ring(s) and a bolt and a nut.
 - d. All buried fittings will be installed, insulated, and sealed in accordance with the piping manufacturer's instructions.
 - e. Fittings shall be third party certified to applicable standards ASTM F877 and CSA B137.5.
- F. Manifold Cabinets:
1. Manifold cabinets, if required, shall be constructed of 18 gauge steel with a gray primer coating.
 2. Cabinets may be surface mount on wall or floor or recessed mount.
 3. Cabinets shall have knockouts on each side and open at bottom or top for tubing.
 4. Cabinets shall be lockable.
- G. Controls:
1. Zone thermostats shall be low-voltage devices with electronic temperature sensing and shall be supplied by the manufacturer as part of a proven catalogued system.
 2. Individual loop actuators shall be low-voltage thermo-electric design for actuation of valves on brass manifold with visual indication of position and built in end switch and supplied by the manufacturer as part of a proven catalogued system.
 3. Individual loop actuators shall be electrically activated by the room thermostats via connection to a multi-zone relay module with the capability to attach an end switch module for activation of pump or heat source control and supplied by the manufacturer as part of a proven catalogued system.
- H. Accessories:
1. Use accessories with the installation of the hydronic radiant heating system as recommended by or available from the manufacturer.
 2. Protective Casings
 - a. Protective casings will be manufactured of high density polyethylene shells with insulation, bolts, nuts, and a sealant compound.
 3. Protective Inspection Chambers
 - a. The piping manufacturer will provide the inspection chambers when required by the project construction.
 - b. Inspection chambers shall be constructed of shock-resistant high density polyethylene.
 - c. Heat shrink seals as provided by the piping manufacturer shall be installed to prevent introduction of water into the vault.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Verify that site conditions are acceptable for installation of the hydronic radiant heating system.
 - a. Verify that work from other trades will not interfere with installation.
 - b. All installation areas shall be cleaned and free from all construction debris.
2. Do not proceed with installation of the hydronic radiant heating system until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Location:

1. The following is a generalized summary of the location of the in-slab PEX tubing that provides the hydronic radiant heat. Final Shop Drawings shall be verified and approved by the engineer before the system is installed.
 - a. Service Building – The Service Building is divided into rooms. The following rooms shall be provided with in-slab hydronic radiant heating system using PEX tubing. See Contract Drawings for detailed room layouts.
 - 1) Sludge Dewatering Room (~750 ft²)
 - 2) Blower Room (~750 ft²)
 - 3) Chemical Room (~750 ft²)
 - 4) Workshop (~380 ft²)
 - b. Screen Building – PEX tubing in-slab, shall be installed in the floor slab, with the following exceptions. The area to be installed with the heating system is approximately 840 ft². See Contract Drawings for detailed building layout.
 - 1) No heating shall be provided in the Channel Island.

B. General:

1. Install system according to design parameters and final shop drawings. All installation notes shown on the drawings shall be followed.
2. Determine manifold locations before installing tubing.
3. Mount manifolds in previously prepared locations and/or in previously installed cabinets. Manifold should be installed as level and plumb as possible.
4. At connections and fittings, use a plastic tubing cutter to ensure square and clean cuts.
5. Tubing shall be dispensed using a suitable uncoiling device. Remove twists prior to securing tubing. Fasten tubing at no more than 3 feet intervals, being careful not to twist the tubing. In thin concrete or gypsum slabs, secure tubing every 2 feet. Use only fasteners supplied or approved by the PEX tubing manufacturer.
6. At time of installation of each loop of tubing, connect the tubing to the correct manifold outlet and record zone area serviced and tubing length for balancing. If manifold is not installed, cap the tubing ends and label the tubing's loop number along with S for supply and R for return and loop length.

7. Manufacturer of finished flooring shall be consulted to confirm maximum surface temperature, maximum increase of temperature rate during startup period, cure rates and any additional information important to maintaining flooring warranty.
8. If the radiant heating system substrate material (thermal mass) requires curing and/or has other limitations which can be influenced by the radiant heating system while in operation, then the radiant heating system shall not be put into operation until such time that the substrate material has fully cured or set according to the material requirements of the substrate manufacturer.

C. Slab-on-Grade:

1. Verify sub-grade is compacted, flat and smooth to prevent damage to pipe or insulation.
2. Approved vapor barrier and thermal insulation, according to design, shall be installed.
3. Reinforcing wire mesh, if required by structural design, must be flat and level.
4. Tubing shall be spaced according to design.
5. Install tubing at a consistent depth below the surface elevation as determined by the design. Ensure sufficient clearance to avoid control joint cuts.
6. In areas where tubing must cross metal expansion joints in the concrete, ensure the tubing passes below the joints. Depending on the manufacturer's and structural engineer's recommendation, fibrous expansion joints may tolerate penetration.
7. Each tubing loop shall be labeled with loop number, loop length and name of zone. Supply and return ends shall be clearly marked.

D. Pre-Insulated Piping:

1. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:
 - a. Watts Radiant R-flex Installation Manual
2. Below-grade Installation:
 - a. Pre-insulated piping shall be installed in accordance with manufacturer's recommendations and the details as shown on the contract drawings.
 - b. The system will be installed with the fewest number of underground joints as possible.
 - c. The system does not require expansion loops, expansion joints or compensators of any type.
 - d. An end cap shall be applied at all terminations of the pre-insulated piping system, including all fitting locations to form a watertight seal.
 - e. All buried fittings will be installed, insulated and sealed in accordance with the piping manufacturer's instructions.
 - f. Protective Inspection Chamber or Protective Casings are required for all below-grade connections.
3. Backfill:
 - a. The pre-insulated piping will be backfilled with clean sand material.
 - 1) R-flex should always be installed below the frost line.
 - 2) Minimum vertical distance from the bottom of the piping to the trench floor is 4 inches (100 mm).

- 3) Minimum lateral distance from the side of the piping to the trench wall is 6 inches (150 mm) for 4.9 inch (125 mm) outer jacket; 7.1 inches (180 mm) for 6.3 inch (160 mm) or 7.9 inch (200 mm) outer jacket.
- 4) Install a minimum of 6 inches (300 mm) of clean fill over the top of the pre-insulated piping.
- 5) Minimum depth of backfill over the sand is 9.9 inches (250 mm) for pedestrian traffic or 25.6 inches (650 mm) for vehicular traffic.
- b. The balance of the trench can be backfilled with native soil void of stone greater than 2 inches (51 mm) in diameter.
 - 1) Caution tape shall be installed in the backfill along the entire length of the trench.

E. Glycol and Water Solution:

1. Glycol and water solution, if required by design, shall be pre-mixed at designated concentration before entering the system.
2. Refer to boiler manufacturer for recommendations and restrictions on the use of glycol and water solutions.

3.3 FIELD QUALITY CONTROL

A. Air Leak Testing:

1. Completed system shall be leak tested by applying air pressure to a minimum of 60 psig (do not exceed 150psig).
2. Use liquid leak detector or soap solution to check for leakage at manifold connections.

B. System Filling and Purging:

1. System shall be filled with required fluid, as determined by design, and purged of air.

C. Liquid Leak Testing:

1. Perform a preliminary leak test by pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100psig for 30 minutes.
 - a. As tubing expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
 - b. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.
2. After successfully performing the preliminary leak test, perform the main leak test immediately.
 - a. The test pressure shall be restored and continued as the main test for 2 hours.
 - b. The system pressure shall not fall more than 3 psig after 2 hours.
 - c. No leakage shall be detected.
3. Test pressure shall be maintained and monitored during installation of the slab.
 - a. If a leak is detected during installation of the slab, leak shall be found immediately and the area cleared for repair using manufacturer's approved repair coupling and heat shrink material.
 - b. Retest before covering repair.

4. If liquid leak test is performed with water, precautions must be taken to prevent freezing until project is complete.
 5. If liquid leak test is performed with water and operating fluid is a glycol and water solution, system must be purged with air before filling with solution.
- D. Complete and furnish leak test reports to owner or general contractor, as required.

3.4 SYSTEM ADJUSTING

- A. Loop Flow Balancing:
1. Equalize the flow in each loop of a manifold. Perform this function for each individual manifold.
- B. Manifold Flow Adjusting:
1. Adjust flow to each individual manifold with the use of a flow control or circuit setter device. Flows determined by design requirements.
- C. Floor Surface Temperatures:
1. Once system is operating at full temperature, verify floor surface temperatures are within design and flooring manufacturer limits.

3.5 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Repair or replace damaged installed products.
- C. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.
- D. Remove construction debris from project site and legally dispose of debris.

3.6 DEMONSTRATION

- A. Demonstrate operation of system to Owner or Owner's personnel.
- B. Instruct Owner or Owner's personnel in type, concentration and maintenance of the water and glycol solution, if present.
- C. Provide Owner or Owner's personnel with manufacturer's installation, operation and maintenance instructions for installed components within the system.

3.7 PROTECTION

- A. Protect installed work from damage by subsequent construction activity on the site.
- B. Provide Owner with photos and drawings of completed work.

3.8 GENERAL – BOILER INSTALLATION

- A. Installation shall be provided by the Contractor in accordance with the requirements of the codes specified hereinbefore. All of the contractor's work shall be performed by experienced personnel previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.
- B. Install equipment in strict compliance with manufacturer's installation instructions. Equipment shall include boiler – as specified in section 2.1.A – and all other equipment as recommended by manufacturer's representative and approved by engineer.
- C. Install equipment in strict compliance with state and local codes and applicable NFPA standards.
- D. Maintain manufacturer's recommended clearances around sides and over top of equipment.
- E. Install components that were removed from equipment for shipping purposes.
- F. Install components that were furnished loose with equipment for field installation.
- G. Provide all interconnecting electrical control and power wiring.
- H. Provide all fuel gas vent and service piping.
- I. Provide all piping for boiler pipe connections.

3.9 FIELD TESTING - BOILER

- A. The manufacturer's representative shall test all boiler and burner interlocks, actuators, valves, controllers, gauges, thermometers, pilot lights, switches, etc. Any malfunctioning component shall be replaced at the time of initial start-up if found to be inoperative.
- B. All adjustments to boiler, burner, and boiler control system shall be performed by the manufacturer's authorized service representative.

3.10 START UP, INSTRUCTION AND WARRANTY SERVICE - BOILER

- A. The manufacturer's representative shall provide start-up and instruction of each new boiler, including burner and boiler control system as specified herein. Start-up and instruction shall cover all components assembled and furnished by the manufacturer whether or not of his own manufacture.
- B. Warranty service shall be in accordance with the manufacturer's warranty statement unless other provisions have been agreed to during project bidding.

END OF SECTION 238316

SECTION 260500 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. General
- B. Intent of Drawings
- C. Interpretation of Drawings
- D. Quality Control
- E. Submittals
- F. Location Environmental Considerations
- G. Products
- H. Coordination
- I. Demolition
- J. Electrical Installation
- K. Relocate or Make Modifications to Any Existing Electrical, Instrumentation or Control Systems Wiring
- L. Quality Assurance
- M. Examination
- N. Preparation and Storage
- O. Installation
- P. Field Quality Control
- Q. Painting
- R. Cleaning
- S. Operation - Maintenance and Spare Parts Data

1.2 GENERAL

- A. The Electrical Contractor shall be responsible to check with the equipment manufactures of the physical size of the equipment that it will fit and that it can be moved into the indicated locations.
- B. Intent of Drawings – The Drawings are not intended to be used for construction purposes for the electrical work, but to supplement the Specifications as to the principal features of the electrical design. The intent of this section is that all equipment and electrical devices furnished and installed under this and other sections of the Specifications be properly interconnected to permit successful system operation regardless of whether all interconnections are specifically referenced in the Specifications and associated Drawings.
- C. Interpretation of Drawings
 - 1. The locations of equipment to which electrical connections are to be made are approximate as shown on the Drawings. It shall be the Electrical Contractor's responsibility to determine the exact conduit locations by reviewing shop drawings. The sizes of disconnect switches, motor starters, overload heaters, fuses or circuit breakers are approximate, and it shall be the Electrical Contractors responsibility to obtain the correct sizes based on the actual installed equipment or items. The conduit and wire sizes shown on the Drawings are the minimum sizes required and shall not be reduced.

- D. Quality Control
1. The Electrical Contractor shall maintain a level of quality of materials and installation means as to assure the completed electrical, instrumentation and control system will be completed in compliance with the Specifications.
- E. Submittals
1. Shop Drawings - Submit shop drawings under provision of Section 01061 for all electrical equipment and devices.
 2. Shop drawings shall include manufacturer's literature, specifications, schematic diagrams, field wiring interconnection diagrams and any other data necessary to indicate compliance with the Specifications
 3. Final "Record" Contract Drawings - Drawings and information required shall include but not be limited to the following:
 - a. Conduit runs shall be shown and identified at each end of run, include where conduit originates and the termination. Each conduit shall have a pull string attached and fastened at each end.
 - b. Power Distribution Schematics - Show actual installed switching details, cable size and type, conduit size, locations and runs, fuse size and type, circuit breaker frame size, trip setting and type.
 - c. Details and Diagrams
 1. Elementary Wiring Diagrams – Show actual motor control wiring with wire numbers, telephone system cable routing and station identification with cable numbers.
 2. One Line Diagrams - Show equipment names, fuse sizes and types, heater sizes, conduit and wire sizes, motor FLA and horsepower. Include wire and cable numbers or identification.
 3. Instrumentation and control Diagrams - Show actual installed, wired instrumentation loop diagrams, include actual installed device Tag Nos, Model Nos, Scaling,
 - d. Lighting and Device Schedule
 1. Show actual manufacturers and model numbers.
 2. Lighting panel layouts
 3. Actual circuit No. circuit description, breaker size and type.
 5. Payment for the Division 16 work and materials shall not exceed 90% of the total bid price until all Operations and Maintenance data and record as built drawings have been completed and received by the Owner.
- G. Location Environmental Considerations
1. Provide satisfactory operation and maintenance under the following conditions
 2. Temperature:
 - a. Outside: - 20° to 110° F
 - b. Inside: +40° to 120° F
 3. Relative Humidity: 100 percent
 4. Process Temperature:
 - a. Liquid: 32° to 105° F
 - b. Air: - 32° to 200° F
 5. Atmosphere:
 - a. As indicated on the drawings
 - b. Corrosive atmosphere Hydrogen Sulfide

- c. Wet Locations
 - 1) As defined in NEC ART. 100.
 - 2) Outside exposed areas, areas indoors near pumps, frequent washdown areas.
- d. The interiors of conduits and raceways located in wet areas shall also be classified as wet areas.
- e. Damp Locations
 - 1) As defined in NEC ART 100
 - 2) Areas under covered enclosures,
- f. Wet and Corrosive areas
 - 1) Enclosures located in areas that are wet and corrosive shall be rated for NEMA 4X Stainless Steel or as noted on the drawings.
- g. Hazardous Areas (Classified)
 - 1) Areas that are a hazardous area are indicated on the drawings. All new equipment and installation methods shall conform to the requirements in the NEC.

H. Products

- 1. Electrical materials and equipment shall be new and shall be labeled by the Underwriters Laboratories, Inc when ever standards have been established and the label service applies.
- 2. Wire and Terminal Labeling - Tag all wire, cable and conduit at each end or termination with suitable permanent tags, printed, stamped, or engraved with the wire, cable or conduit number. The figures on the tags shall be clear and legible.
- 3. Safety Signs - High voltage warning signs shall be provided and placed at all guarded locations as required by the N.E.C. The signs shall be permanent and conspicuous, and shall be plainly visible even when doors are open or panels removed from compartments.
- 4. Engraved Nameplates - Identify all electrical enclosures with engraved phenolic nameplates. Engrave and mount nameplates for all switchgear, disconnect switches, and individual motor starter enclosures indicating equipment served. Nameplates shall be **white with black letters**. Minimum letter size shall be one-quarter inch.

I. Demolition

- 1. Electrical Contractor shall disconnect power from existing equipment to be removed. General Contractor to remove and dispose of actual equipment.
- 2. Electrical contractor shall perform the demolition of electrical equipment where indicated on the electrical contract drawings.

J. Electrical Installation

- 1. Electrical Contractor shall furnish and install, adjust, connect, and put into satisfactory operation all electrical equipment, control components and instrumentation items as indicated on the Drawings and specified herein.

K. Coordination

- 1. Electrical Contractor shall review all Specifications and Drawings for the electrical work included under these sections and coordinate this work. Investigate existing conditions in the field before submitting proposal. Become acquainted with the conditions under which the work of this section of the Specifications will be performed and accept all conditions as found.

2. Schedule and coordinate all relocations of, or modifications to electrical, instrumentation or control systems wiring, conduit equipment, or appurtenances to whatever extent is necessary and required in order to conform to structural and architectural conditions, duct work and piping interference's, etc., shall be included under this section of the Specifications.
3. Coordinate with other trades on the project so that all trades install their work to avoid interference with each other. Arrangements made among the trades which result in deviations from Drawings and Specifications are subject to the approval of the Owner.
4. The control panels and/or equipment are to be provided by the equipment supplier, General Contractor, and System Integrator. These items will require power and/or interconnections from the disconnect switch to the control panel and/or field mounted devices or junction boxes for power and control. Specific details to be determined by the shop drawings.

1.3 REFERENCES

- A. American National Standards Institute (ANSI).
- B. Factory Mutual Engineering Division (FM).
- C. Illumination Engineering Society (IES).
- D. Institute of Electrical & Electronics Engineers (IEEE).
- E. Insulated Cable Engineers Association (ICEA).
- F. Instrumentation, Systems and Automation Society (ISA)
- G. Joint Industrial Council (JIC).
- H. National Electrical Code (NEC).
- I. National Electrical Manufacturers Association (NEMA).
- J. International Electrical Testing Association (NETA).
- K. National Fire Protection Association (NFPA)
- L. Occupational Safety and Health Administration (OSHA)
- M. Ohio Building Code (OBC).
- N. Underwriters' Laboratories Incorporated (UL).
- O. ANSI/NEMA 1-2000 Standard Practices for Good Workmanship in Electrical Contracting.
- P. Quality Assurance
 1. Regulatory requirements
 - a. The Contractor shall obtain and pay for all fees for permits and inspections as required.
 2. Installation Standards
 - a. NEC – installation of electrical items shall be in accordance with the NEC.
 - b. Instrumentation and control – Installation of the instrumentation, control system shall be in accordance with standards of the ISA.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all devices at delivery for damage.
- B. Confirm all devices at delivery are as required according to design and shop drawings.
- C. Examine the site and structures for any obstructions which may interfere with the electrical installation as planned.

3.2 PREPARATION AND STORAGE

- A. Provide a dry heated storage area for all electrical and electronic equipment and devices.
- B. Electrical and electronic equipment devices shall be stored and shall be heated to prevent condensation from forming. Electrical and electronic equipment found with condensation in the enclosure or condensation caused damage will not be accepted.

3.3 INSTALLATION

- A. The locations of equipment to which electrical connections are to be made are approximate as indicated on the Drawings.
- B. It shall be the Contractor's responsibility to check shop drawings relating to equipment requiring electrical connections and to determine the exact conduit locations.
- C. Electrical and electronic equipment installed but not energized shall continue to have a heat source to maintain the enclosure free of condensation. Electrical and electronic equipment found with condensation in the enclosure or condensation caused damage will not be accepted.
- D. Contractor shall perform all chasing, channeling, drilling and patching necessary. Repair any damage to the building or any equipment. Replace damaged equipment if, in the Engineer's judgment, the repair would not be satisfactory.
- E. No work shall be covered or hidden from view until it has been inspected and approved by the Owner.
- F. Any workmanship or materials not meeting the requirements of the Specifications or Drawings shall be immediately replaced by the Contractor without cost to the Owner and to the satisfaction of the Owner.
- G. All wiring shall have permanent labels at all terminations and junctions of the wires and on all field wiring terminal strips.
- H. Safety signs shall be furnished and installed on or around all electrical equipment.
- I. Permanent marking labels shall be installed on exposed sides of each piece of electrical equipment, pull boxes, junction boxes and terminal boxes stating the maximum voltage level involved with the associated equipment.
- J. Concrete equipment pads for electrical equipment shall be furnished and placed by the Electrical Contractor.

3.4 PAINTING

- A. All wood panel mounting boards shall be painted.
- B. All electrical enclosures shall undergo a phosphatizing prepainting treatment. Final paint coats shall be a polyester powder coating with ANSI 61 light gray color for

enclosures mounted inside and with ANSI 24 medium gray color for enclosures mounted outside.

- C. Remove any rust and touch up any scratches on all new electrical devices or enclosures with matching touch-up paint as supplied by the manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Major components of the Electrical System shall be tested per NETA standards. NETA's Standard Specification for Testing, Parts 1 to 5, shall govern all testing.
- B. The following tests are per NETA Acceptance Testing Specifications, Part 7, Inspection and Test Procedures. Visual and Mechanical Inspections shall be performed for all equipment.
 - 1. Cables - Low Voltage shall have the following tests: Insulation resistance, continuity.
 - 2. Circuit Breakers - Low Voltage (Molded Case) that are rated at over 100 amps shall have the following tests: Contact resistance, time-current characteristic, instantaneous pickup current, insulation resistance.
 - 3. Grounding Systems shall have the following test: Fall of potential.
 - 4. Surge Arresters shall have the following tests: 60 hz sparkover, insulation power factor, ground continuity.
- C. After all testing has been completed to the satisfaction of the Owner, the entire Electrical (Power) System shall operate for a minimum test period of 30 days. Cumulative down time of all components furnished under Division 16 shall not exceed 1/2 hour as recorded by the Engineer during the test period. System documentation shall be delivered on the last day of test period. Test period shall not end until system documentation has been delivered. If the cumulative downtime limit is exceeded, the Engineer shall have the following options.
 - 1. Extend the test period as required until the cumulative downtime during the proceeding 30 days does not exceed 1/2 hour as recorded by the Engineer.
 - 2. Sub-systems which have no components contributing to the cumulative downtime will be approved as a partial acceptance.
- D. Sub-systems which have components that contributed to the cumulative downtime shall have their test period begin after all repairs and adjustments have been made.

3.6 OPERATION - MAINTENANCE AND SPARE PARTS DATA

- A. Submit specific data and information required under individual Division 16 Sections.
 - 1. Submit operation data as required.
 - 2. Submit maintenance data as required.
 - 3. Spare Parts Data - Submit as required. Include manufacturer's list of recommended spare parts.
 - 4. Parts and supplies judged to be necessary to keep equipment and control system operating successfully for first year of operation shall be furnished.
 - 5. Review individual sections for required lists of spare parts to be furnished.

3.7 CLEANING

- A. All areas are to be cleaned of construction debris and wire. Electrical equipment is to be cleaned of all construction dirt, dust, etc.
- B. All electrical and electronic equipment shall be kept clean and free of all dust, dirt, and debris at all times.
- C. All electrical and electronic boxes and enclosures shall have the covers of these boxes and enclosures closed and sealed except when actually working in these boxes and enclosures.

END OF SECTION 260500

SECTION 260519 – CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Wiring connectors and connections.

1.2 RELATED SECTIONS

- A. Section 260553 - Electrical Identification.

1.3 REFERENCES

- A. Quality Control: Follow requirements for references and standards.
- B. NECA Standard of Installation (National Electrical Contractors Association).
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
- D. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

- A. Submittals: Follow procedures for submittals.
- B. Product Data: Provide for each cable assembly type.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Contract Closeout Submittals – Follow as required.
- B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated.
- B. Conductor sizes are based on copper only.
- C. Wire and cable routing indicated is approximate unless dimensioned.

1.9 COORDINATION

- A. Coordinate Work under provisions of Section 260500.
- B. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. Okonite Company.
 - 2. Alpha Wire Company.
 - 3. Southwire
 - 4. Substitutions: Follow as required for Material and Equipment.
- B. Description: Multi-stranded insulated copper wire, #12 AWG minimum for feeders and branch circuits and #14 AWG minimum for control circuits.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70; Type XHHW or THWN insulation for service, feeders and branch circuits and control circuits.

2.2 WIRING CONNECTORS

- A. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
- B. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller. Buchanan crimp (Split cap and insulator) or Ideal crimp connector with wrap cap insulator.
- C. Use Adhesive-lined heat shrink tubing for watertight connections; T & B, 3M, or Raychem.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Quality Control: Follow as required by manufacturer's instructions.
- B. Route wire and cable as required to meet Project Conditions.
- C. Install cable in accordance with the NECA "Standard of Installation."
- D. Use stranded conductors for control circuits.
- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use conductor not smaller than 14 AWG for control circuits.
- G. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).
- H. Pull all conductors into raceway at same time.
- I. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- J. Protect exposed cable from damage.
- K. Use suitable cable fittings and connectors.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape un-insulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- R. Identify and color code wire and cable under provisions of Section 16075. Identify each conductor with its circuit number or other designation indicated.
- S. Replace conductors damaged during installation.
- T. No splices are allowed in conduits or raceways.

3.4 FIELD QUALITY CONTROL

- A. Starting of Systems: Follow requirements for field inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 260519

SECTION 260520 – SHIELDED INSTRUMENTATION & VARIABLE FREQUENCY DRIVE CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Furnish all labor, materials, equipment and incidentals required to provide shielded cable as shown and specified.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Comply with Section 013323.
- B. Product data:
 - 1. Submit for review, copies of manufacturer's engineering data and technical information for shielded instrumentation cables proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Instrumentation Cable
 - 1. Single Shielded Pair or Triad: 300 volt.
 - a. Tinned copper, 18 AWG or larger, stranded, polyethylene insulated conductors twisted with aluminum-polyester shield, stranded tinned 20 AWG copper drain wire and overall chrome vinyl jacket, 100 percent shield cover. Rated for 300 volts minimum.
 - b. Products and Manufacturers:
 - 1) Belden No. 8760, No. 8770, No. 9318, or No. 9365
 - 2) Alpha No. 2422, No. 2432.
 - 2. Multi-paired Shielded 300 volt:
 - a. Tinned copper, 18 AWG, stranded PVC insulated conductors, twisted in pairs with aluminum-polyester shield over each pair and its stranded drain wire (20 AWG), overall chrome vinyl jacket, 100 percent shield cover.
 - b. Products and Manufacturers:
 - 1) 3 pair - Belden No. 9369.
 - 2) 6 pair - Belden No. 9389.
 - 3) 9 pair - Belden No. 9390.
 - 4) 11 pair - Belden No. 9391.
 - 5) 15 pair - Belden No. 9392.
 - 6) Dekoron Poly-set.
 - 7) Okonite type SP-OS.
- B. Variable Frequency Drive Shielded Cable

1. Four conductor shielded cable
 - a. Shielding to have an overall shield with an 85% tinned copper braided shield.
 - b. Cable to be Belden Variable Frequency Drive Cable 29502 through 29531 wire size as indicated or equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Delivery, Storage and Protection: Comply with Section 016600.

3.2 INSTALLATION

- A. Install in conduit separated from power cables unless otherwise shown on the Drawings.
- B. Install instrumentation cable conduits as far as possible from power cable conduit.
- C. Ground shield at one end only, as recommended by instrument manufacturer, and as approved by the Owner.
- D. Terminate stranded conductors with pre-insulated crimp type ring tongue terminals properly sized to fit fastening device and to fit wire size.
- E. Identification: Identify all conductors at each terminal and splice location. Identification number labels shall be Thomas & Betts type WSL cable markers or equal with clear heat shrink tubing over the marker.
- F. Install CAT 5e and CAT 6 cabling in accordance with Commercial Building Telecommunications Pathways and Spaces ANSI/TIA/EIA 569-A and Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-A.

3.3 TESTING

- A. Test each circuit in the presence of the Owner after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
- B. Maintain a written record of circuits being tested, marking down circuit number and descriptive function and results of each step in the test procedures including repeated tests.
- C. Any cable or a portion of the cable which fails when tested shall be replaced with a new cable for the full length and retested.

END OF SECTION 260520

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.2 RELATED SECTIONS

- A. Section 033000 - Cast-In-Place Concrete

1.3 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.4 GROUNDING SYSTEM DESCRIPTION

- A. The system shall consist of a series of driven ground rod electrodes interconnected with bare stranded ground conductor.
- B. All building footer and slab rebar greater than ½" shall be bonded to the ground conductor. Bond at 20 ft intervals and at each corner. IAW NEC. Connections to rebar may be made with suitable sized ground clamps.
- C. All connections shall be by exothermic welds (Cadweld or equal) installed according to the manufacturer's instructions.
- D. Tests shall be performed to determine the grounding grid resistance to ground. The test method shall be as described in NETA Standard ATS-1987, "Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems." A three-point fall-of-potential test shall be used using two auxiliary electrodes for the measurement. Test reports shall be provided describing the testing procedure and results. The grid-to-ground resistance shall be no greater than 5 ohms. If necessary, additional rods shall be added to achieve the 5-ohm ground. When the Contractor has obtained satisfactory results, he shall submit test reports to the Engineer for approval. After approval, the contractor shall bond the service entrance ground grid to the service entrance enclosure ground bus. The Owner or Owner's representative shall have the opportunity to inspect all exothermic welds.
- E. All ground cables shall have a minimum of 24" of ground cover.

1.5 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms maximum.

1.6 SUBMITTALS

- A. Product Data: Provide for grounding electrodes and connections.
- B. Test Reports: Indicate overall resistance to ground (and resistance of each electrode).
- C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 260500.
- B. Accurately record actual locations of grounding electrodes.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

- A. Manufacturers:
 - 1. ITT Blackburn Co.
 - 2. Copperweld, Bimetallic.
 - 3. American Electric - Blackburn.
- B. Material: Copper-clad steel.
- C. Diameter: 3/4 inch.
- D. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

- A. Manufacturers:
 - 1. Burndy Corp.
 - 2. O-Z/Gedney.
- B. Material: Bronze.

2.3 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
 - 1. Cadweld.

2.4 WIRE

- A. Material: Stranded copper.
- B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground spaced at minimum 10 FT.
- C. Provide bonding to meet Regulatory Requirements.
- D. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.
- C. Concrete equipment supports

1.2 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. Anchors and Fasteners:
 - 1. Concrete block walls: Use expansion anchors.
 - 2. Steel Structural Elements: Use welded fasteners.
 - 3. Concrete Surfaces: Use expansion anchors.

2.2 CHANNEL SYSTEMS

- A. Manufacturer:
 - 1. Unistrut, B-Line, Allied Power -Strut.
 - 2. or Equal

- B. Description:
 - 1. Galvanized steel. - General locations
 - 2. Aluminum- Wet, damp areas
 - 3. Stainless steel - Wet, damp corrosive areas where compatible with chemicals
 - 4. Fiberglass - Wet, damp, corrosive areas where compatible with chemicals
- C. Size: 1 5/8" X 1 5/8"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- C. Do not fasten supports to pipes and conduit except as shown on Drawings.
- D. Obtain permission from Engineer before drilling or cutting structural members.
- E. Fabricate supports from structural steel, galvanized steel, aluminum or stainless steel channel. Rigidly weld members or use stainless steel hex head bolts and hardware to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- F. Install surface-mounted cabinets and panel boards with minimum of four anchors.
- G. In wet and damp locations use stainless steel or aluminum channel supports with stainless steel fasteners.
- H. In wet and damp locations use stainless steel or aluminum spacers to stand cabinets and panel boards one inch off wall.
- I. Spray coat cut end of galvanized steel channel or rigid steel conduit with spray cold galvanizing.
- J. Galvanized pipe used as equipment supports are to have the open ends capped with galvanized end caps.
- K. Provide concrete equipment pad, housekeeping pads, for all equipment that will be floor mounted. Pads to be formed, chamfer edges, and have a troweled finish. Concrete shall be smoothed around conduits. Equipment panels shall be anchored using concrete anchors. Equipment pads for outdoor mounted panels shall extend from the front of the equipment panel 3'-6" min. to allow for opening and standing.

END OF SECTION 260529

SECTION 260530 – ELECTRICAL DUCT BANK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. PVC conduit.
- B. Pull Boxes/Handhole Enclosures

1.2 MEASUREMENT AND PAYMENT

- A. Duct bank:
 - 1. Basis of Payment: Includes purchase, delivery, and installation of duct, fittings, supports, accessories, trenching, aggregate bedding or concrete encasement (where required), and backfill.
- B. Pull Boxes/Handhole Enclosures
 - 1. Basis of Payment: Includes purchase, delivery, and installation of pull box.

1.4 REFERENCES

- A. Quality Control: Follow requirements for references and standards.
- B. ASTM C857 - Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
- C. ASTM C858 - Underground Precast Concrete Utility Structures.
- D. STM C891 - Installation of Underground Precast Utility Structures.
- E. ASTM C1037 - Inspection of Underground Precast Utility Structures.
- F. IEEE C2 - National Electrical Safety Code.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- H. NEMA TC 2 and TC3 - Schedule 40 PVC Conduit and PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- I. NFPA 70 - National Electrical Code.
- J. UL 651A - Type EB and A PVC Conduit and HDPE Conduit.
- K. ANSI/SCTE 77-2007 Specifications for Underground Enclosure Integrity.

1.5 SUBMITTALS FOR REVIEW

- A. Submittals: Follow procedures for submittals.
- B. Product Data: Provide for manhole accessories.
- C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

1.6 SUBMITTALS FOR INFORMATION

- A. Follow requirements for submittals in general project requirements.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.7 SUBMITTALS FOR CLOSEOUT

- A. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.9 FIELD SAMPLES

- A. Provide as required.

1.10 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.
- B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- C. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.
- D. Pull box locations and quantity are shown in approximate locations. Locate as required to complete duct bank system.

PART 2 - PRODUCTS

2.1 PLASTIC CONDUIT

- A. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.
- B. Rigid Plastic Underground Conduit: UL 651A, Type A PVC.

2.2 DUCT BANK PULL BOXES

- A. Description: Pull boxes shall be as manufactured by Quazite.
- B. Load capacity of box to be as indicated on drawings or as indicated in ANSI SCTE-77-2007.
- B. Provide all necessary items for a complete installation.
- C. Pull boxes shown are approximate sizes. Size pull boxes as required for proper installation.
- D. Enclosure with Walls 48" or Shorter
 - 1. Enclosures, boxes and cover are required to conform to all test provisions of ANSI/SCTE 77 "Specifications for Underground Enclosure Integrity" for Tier as shown on Drawings. When multiple Tiers are specified,

the boxes must physically accommodate and structurally support compatible covers while possessing the highest Tier rating. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box & cover) are manufactured using matched surface tooling. All covers are required to have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level embossed on the top surface. Independent third party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal.

2.3 ACCESSORIES

- A. Underground Warning Tape: 4-inch-wide plastic tape, metal-backed, colored red or yellow with suitable warning legend describing buried electrical lines.
- B. Underground conduit PVC support chairs

PART 3 - EXECUTION

3.1 DUCT BANK INSTALLATION

- A. Quality Control: Follow requirements in manufacturer's instructions.
- B. Install duct to locate top of duct bank at depths as indicated on drawings.
- C. Install duct with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances.
- D. Cut duct square using saw or pipe cutter; de-burr cut ends.
- E. Insert duct to shoulder of fittings; fasten securely.
- F. Join nonmetallic duct using adhesive as recommended by manufacturer.
- G. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- H. Install no more than equivalent of three 90-degree bends between pull points.
- I. Use suitable separators and chairs installed not greater than 4 feet on centers.
- J. Conduit spacing shall be 12" minimum from 480/277 volt conduits to mA/communication signal conduits and 6" minimum from 120/240 volt conduits and mA/communication signal conduits.
- K. Provide suitable pull string in each empty duct.
- L. Swab duct with wire brush and mandrel. Use suitable caps to protect installed duct against entrance of dirt and moisture.

- M. Backfill as required in Backfill Section. Aggregate bedding shall be placed and tamped in layers. Bedding shall be placed in trench bottom prior to installation of the bottom ducts.
- N. Concrete encasement required where indicated. Ensure that concrete totally encases conduits in duct bank to eliminate any voids.
- P. Interface installation of underground warning tape with backfilling as required in Backfill Section. Install tape 6 inches below finished surface.
- Q. Install a vertical two-foot length of #8 rebar to extend to 6" below finish grade at each duct bank intersection, bend and at 100 ft intervals of straight duct bank run for locating the duct bank

3.3 PULL BOXES/HANDHOLE ENCLOSURES

- A. Quality Control: Follow requirements in manufacturer's instructions.
- B. Excavate for manhole installation under the provisions of Excavation Section.
- C. Excavate hole approximately 8" deeper than the depth of the pull box at finished grade and approximately 8" larger than the box. Provide minimum of 6 – 8 inches of gravel in the excavation bottom. Compact gravel to minimize settling.
- D. Set box on compacted gravel and backfill to finished grade.
- E. Install in accordance with NEC 314.30.

END OF SECTION 260530

SECTION 260533 - CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal conduit.
 - 1. Rigid Galvanized Steel
 - 2. Aluminum
- B. PVC coated rigid galvanized steel.
- C. Nonmetallic conduit.
- D. Flexible metal conduit.
- E. Liquid-tight flexible metal conduit.
- F. Fittings and conduit bodies.

1.2 RELATED SECTIONS

- A. Section 260529 - Supporting Devices.
- B. Section 260553 - Electrical Identification.
- C. Sections 260534- Boxes.

1.3 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.5 - Rigid Aluminum Conduit
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NECA "Standard of Installation."
- F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.

1.5 SUBMITTALS

- A. Submit under provisions of Section 012333.
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquid-tight flexible metal conduit, nonmetallic conduit, flexible nonmetallic conduit, fittings, conduit bodies of each type planned to be used.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of project general requirements.

- B. Accurately record actual routing of all conduits exposed and concealed on record drawings.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Section 016600.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.9 PROJECT CONDITIONS

- A. Verify routing and termination locations of conduit prior to rough-in.
- B. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4 inch unless otherwise specified.
- B. Underground Installations:
 - 1. More than two feet from Foundation Wall: Use schedule 40 PVC conduit.
 - 2. Within two feet from Foundation Wall: Use plastic coated galv. rigid conduit.
 - 3. In or Under Slab on Grade: Use schedule 40 PVC conduit.
 - 4. When changing from underground to above ground, use PVC coated galv. rigid conduit to approximately two feet above finished grade.
 - 5. Conduits passing through poured concrete sidewalks, floating type slabs on grade shall be sleeved.
- C. Outdoor Locations, Above Grade: Use rigid galvanized steel conduit.
- D. In Slab Above Grade:
 - 1. Use schedule 40 PVC.
 - 2. Maximum Size Conduit in Slab: 3/4" for conduits crossing each other.
- E. Continuously Wet and Damp Locations: Use aluminum or PVC coated rigid steel conduit.
- F. Corrosive Location: Use PVC coated rigid steel or schedule 40 PVC.
- G. Dry Locations:
 - 1. Concealed in framed wall or above suspended ceilings: Use steel electrical metallic tubing or schedule 40 PVC conduit.

- 2. Exposed: Use rigid galvanized steel or aluminum conduit or as noted on drawings.
- 3. Flexible metal conduit can be used for equipment connections. Max length of 3ft.
- H. Classified hazardous Class 1, Division 1 areas & Screen Rooms: PVC coated rigid steel conduit and explosion-proof flexible equipment connections.
- I. Equipment Connections:
 - 1. Use liquid-tight flexible metal conduit.
 - 2. In corrosive or chemical rooms, use non-metallic flexible conduit and fittings.
- J. Flexible Conduits shall be limited to three feet or less.

2.2 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1 all steel fittings.

2.3 PVC COATED METAL CONDUIT

- A. Manufacturers:
 - 1. Robroy Industries "Plasti-Bond."
 - 2. Thomas –Betts – “OCAL Blue”.
- B. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 FLEXIBLE METAL CONDUIT

- A. Description: Interlocked aluminum construction.
- B. Fittings: ANSI/NEMA FB 1.

2.5 LIQUID TIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Sealtight VA Anaconda Metal Hose Div.
 - 2. Liquidtight type L.A. Electric Flex Co.
- B. Description: Interlocked aluminum construction with PVC jacket.
- C. Fittings: ANSI/NEMA FB 1.

2.6 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Carlon Electrical Products Div.
 - 2. LCP.
 - 3. Quil.
- B. Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- F. Fasten conduit supports to building structure and surfaces under provisions of Section 260529.
- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
- H. Do not attach conduit to ceiling support wires.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route exposed conduit parallel and perpendicular to walls.
- K. Route conduit in and under slab from point-to-point.
- L. Do not cross conduits in slab unless $\frac{3}{4}$ " conduits.
- M. Maintain adequate clearance between conduit and piping.
- N. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- O. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- P. Bring conduit to shoulder of fittings; fasten securely.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit

bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.

- T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- U. Provide suitable fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints.
- V. Conduits shall be sloped in such a manner that water may drain to the closest pull box if possible.
- W. Provide suitable pull string in each empty conduit except sleeves and nipples.
- X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Y. Ground and bond conduit under provisions of Section 260526.
- Z. Identify conduit under provisions of Section 260553.
- AA. Flexible conduit, non-metallic, liquid-tight and metallic, shall not be used in length longer than 6 ft unless specifically approved. Flexible conduit is not to be used in place of neatly run rigid conduit.
- AB. Where called out on plans provide cable terminators / sealing bushings, CRC by O-Z/Gedney or approved equal. Verify specific cable outside diameters and follow manufacturer's installation requirements.

END OF SECTION 260533

SECTION 260534 - PULL, JUNCTION BOXES AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pull Boxes
- B. Junction Boxes
- C. Accessories

1.2 RELATED SECTIONS

- A. Section 260529 - Supporting Devices.

1.3 REFERENCES

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
- C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Submit under provisions of general project requirements and Section 260500.
- B. Product Data: Provide manufacturer's standard data for boxes and enclosures.
- C. Junction box locations and details
 - 1. Terminal block layout
 - 2. Grounding

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hoffman.
- B. Rittal.
- C. Or Equal

2.2 PULL BOXES

- A. Construction:
 - 1. Outdoors, Wet Damp areas, Corrosive areas. NEMA Type 4/4X, sunlight

resistant fiberglass, polycarbonate or SS as specified on Drawings, enclosure with continuous hinge covers.

- a. Covers: Continuous SS hinge, held closed by SS screws
2. Indoors exposed NEMA 12, 13 or as specified on Drawings.
3. Indoors flush wall mounted NEMA 1 w/ flush covers
4. Indoors concealed NEMA 1 w/ screw cover
5. Indoor wet and damp NEMA 4XSS
6. Indoor corrosive areas NEMA 4XSS or compatible with chemical
7. Hazardous locations NEMA 7

2.3 TERMINAL HINGED COVER ENCLOSURES

A. Construction:

1. Outdoor, Wet Damp areas, Corrosive areas. NEMA 4/4X, sunlight resistant fiberglass or polycarbonate or SS as specified on Drawings, Type 4/4X enclosure with continuous hinge cover.
 - a. Covers: Continuous SS hinge, held closed by flush latch operable by screwdriver.
 2. Indoors exposed NEMA 12, 13
 3. Indoors flush wall mounted NEMA 1 w/ flush covers
 4. Indoors concealed NEMA 1 w/ screw cover
 5. Indoor wet and damp NEMA 4XSS
 6. Indoor corrosive areas NEMA 4XSS or compatible with chemical
 7. Hazardous locations NEMA 7
- B. Provide white enamel interior metal panel for mounting terminal blocks and electrical components.

2.4 CABINETS

- A. Provide metal barriers to form separate compartments containing control wiring at less than 50 volts from power wiring.
- B. Provide accessory feet for free-standing equipment.

2.5 TERMINAL BLOCKS

A. Manufacturers:

1. Weidmuller SAK 6, SAK 2.5, ASK 1.
 2. Allen-Bradley
 3. Sq. D
 4. Or equal
- B. Terminal Blocks: ANSI/NEMA ICS 4.
- C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts. Ground terminal shall be green.
- E. Provide ground bus terminal block, with each connector bonded to enclosure.

- F. Provide a typed legend of cables and terminal numbers with origin and destination.
- G. Boxes where water may drain from the attached conduits shall have drains installed in the bottom or the lowest point of the box. Conduit penetration at such boxes shall be located along the sides or top of the box. Conduits shall not be installed in a manner that water can enter attached pull conduits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.
- C. Do not attach boxes directly to masonry, concrete, or brick walls but provide a ¼ inch spacer of PVC, nylon, or stainless steel.
- D. Install enclosures and boxes using stainless steel fasteners.
- E. Provide supports where required when no wall or other adequate support is available.

END OF SECTION 260534

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Submit under provisions of Section 260500.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates:
 - 1. Equipment Identification: Engraved three-layer laminated plastic, black letters on white background.
 - 2. Emergency Powered Equipment: Engraved three-layer laminated plastic, black letters on red background. As required by NEC
 - 3. Equipment power source identification: Engraved three-layer laminated plastic, black letters on yellow background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.
 - 2. Junction box.
- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.
 - 2. Use 1/4 inch letters for identifying grouped equipment and loads.

- D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, and control device stations.

2.2 WIRE MARKERS

- A. Manufacturers:
 - 1. T & B Shrink-Kon HVM wire markers.
 - 2. Panduit - Pan Code HSDL.
 - 3. Brady.
- B. Description: Tubing type wire markers.
- C. Locations: Each conductor at panelboard gutters, outlet and junction boxes, terminal strip and each load connection.
- D. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.
 - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings or on shop drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel screws, rivets, or adhesive.
- C. Identify underground conduits using foil backed underground warning tape. Install one tape per trench at 6 inches below finished grade.

END OF SECTION 260553

SECTION 262213 - DRY-TYPE TRANSFORMERS (600 V AND LESS)

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 types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.
 - 2. Control and signal transformers.

1.3 SUBMITTALS

- A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Wiring and connection diagrams.
- C. Source quality-control test reports.
- D. Output Settings Reports: Record of tap adjustments specified in Part 3.

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 IEEE C 57.12.91.
- C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D/ Schneider.
 - 4. Engineer Approved Equal

2.2 MATERIALS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices, except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Ventilated, drip proof, NEMA 250, Type 2.
- D. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."
 - 1. Finish Color: Gray.
- E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- F. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- I. Select features from six paragraphs and associated subparagraphs below. Coordinate with Drawings.
- J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
 - 3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minus 120 dBA minimum at 0.5 to 1.5 kHz; minus 65 dBA minimum at 1.5 to 100 kHz.
 - c. Normal-Mode Noise Attenuation: Minus 52 dBA minimum at 1.5 to 10 kHz.
- K. Wall Brackets: Manufacturer's standard brackets.

2.4 CONTROL AND SIGNAL TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Division 16 Section "Electrical Supports."
- B. Install floor-mounting transformers level on concrete bases not less than 2 inches larger in both directions than supported unit and 4 inches high.
 - 1. Anchor transformers to concrete bases according to manufacturer's written instructions.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 262213

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lighting and Distribution Panelboards.
- B. Power Distribution Panelboards
- C. Surge Protective Device (SPD)

1.2 REFERENCES

- A. NECA Standard of Installation (published by the National Electrical Contractors Association).
- B. NEMA PB 1 - Panelboards.
- C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
- E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

1.4 SUBMITTALS FOR CLOSEOUT

- A. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- B. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc.

1.6 MAINTENANCE MATERIALS

- A. Furnish two of each panelboard key.

PART 2 - PRODUCTS

2.1 LIGHTING AND DISTRIBUTION PANELBOARDS

- A. Manufacturers:
 - 1. Eaton
 - 2. Square D.
 - 3. General Electric
 - 4. Substitutions: Engineer Approved Equal.
- B. Description: NEMA PB1, circuit breaker type, lighting and distribution branch circuit panelboard.
- C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated copper neutral bus. Provide copper line lugs.
- D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical rating for 120/208V panelboard, or as indicated on drawings.
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter or equipment protection circuit breakers where scheduled. Do not use tandem circuit breakers.
- F. Enclosure: NEMA PB 1, Type 1 cabinet box, or NEMA 12 as indicated.
- G. Cabinet Front: Surface type, hinged door with flush lock, finished in ANSI 61 light gray enamel.

2.2 SURGE PROTECTIVE DEVICE (SPD)

- A. For each panelboard provide surge protection device in accordance with section 264313.

2.3 POWER DISTRIBUTION PANELBOARDS

- A. Manufacturers:
 - 1. Eaton.
 - 2. Square D.
 - 3. Siemens Energy and Automation
 - 4. General Electric
 - 5. Substitutions: Engineer Approved Equal.
- B. Description: NEMA PB1, circuit breaker type, Power distribution branch circuit

panelboard.

- C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus, provide copper neutral bus. Provide copper line lugs.
- D. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical overall series rating for 480V panelboard or as indicated on drawings.
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- F. Cabinet: Cabinet to be NEMA 1 gasketed

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and the NECA "Standard of Installation."
- B. Install panelboards plumb.
- C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 260553.
- G. Ground and bond panelboard enclosure according to Section 260526.

3.2 ADJUSTING

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 262416

SECTION 262419 - MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install motor control centers.

B. Coordination:

1. Obtain motor nameplate data on existing equipment or new equipment being furnished for properly sizing circuit breakers, starters and overloads.
2. Obtain data on motor space heater and other accessories for properly sizing control power transformers.

C. Related Sections:

1. Section 260553, Electrical Identification.
2. Section 264313, Surge Protection Device

1.2 REFERENCES

A. Standards referenced in this Section are:

1. NEMA ICS 18-2001, Motor Control Centers.
2. International Electrical Testing Association, (NETA) Acceptance Testing Specification.
3. UL 845, Motor Control Centers.
4. ANSI C37.2, Standard Electrical Power System Device Function Numbers.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. NEC Article 430, Motors, Motor Circuits, and Controllers.

B. Field Quality Control: Field acceptance testing of motor control centers will be manufacturer service tests.

C. Test Equipment, Calibration and Reporting: All test equipment, instrument calibration and test reports shall be in accordance with latest edition of NETA Acceptance Testing Specifications.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following:

1. Product Data: Manufacturer specifications, cut sheets, dimensions, and technical data for all components, materials, and equipment proposed.
 2. Outline and summary sheets with schedules of equipment in each unit.
 3. One-line diagrams indicating circuit breaker sizes, bus rating, motor controller ratings, and other pertinent information to demonstrate compliance with the Contract Documents.
 4. Unit control schematic and elementary wiring diagrams showing numbered terminal points and interconnections to other units.
- B. Test Plans and Reports: Thirty days in advance of actual factory and field testing, submit proposed testing methods, procedures, and apparatus. Submit reports of completed factory and field testing, including procedures and test results.
- C. Operation and Maintenance Data:
1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, and spare parts information.
 2. Manuals shall include record drawings of control schematics, including point-to-point wiring diagrams.
 3. Furnish operation and maintenance manuals per Section 01781, Operation and Maintenance Data.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Shipping containers shall be designed to be shipped by truck, rail, or ship. Indoor containers shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.
3. Inspect motor control centers for shipping damage or loose parts upon delivery. Check for evidence of water that may have entered equipment during transit.

B. Handling:

1. Lift, roll or jack motor control center equipment into locations shown.
2. Motor control centers shall be equipped to be handled by crane. Where cranes are not available equipment shall be suitable for placement on rollers using jacks to raise and lower the groups.

C. Storage:

1. Store motor control center equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

1.6 MAINTENANCE

A. Spare Parts:

1. Furnish, tag, and box for shipment and long term storage the following spare parts and special tools for each motor control center lineup:

Item	Quantity per Switchgear Lineup
a. Starters and feeder breakers	Quantities and sizes as shown
b. Fuses	Six of each type and size used
c. Auxiliary control relays	Two, with at least two normally open and two normally closed contacts
d. Control power transformers	Two of each size used
e. Indicating lamps	Twelve
f. Covers for indicating lamps	Six of each color used
g. Starters: Contact kits for Size 1 motor starter	Five sets
h. Starters: Contact kits for Size 2, Size 3, and Size 4 motor starters	One set of each size

- B. Furnish a list of additional recommended spare parts for an operating period of one year. Describe each part, the quantity recommended and current unit price.
 1. Package spare parts in suitable containers bearing labels clearly indicating the contents and equipment with which they are to be used. Deliver spare parts at the same time as the motor control centers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products of one of the following:
 1. Square D Company.
 2. Eaton.
 3. Or equal.

2.2 MATERIALS

- A. General: Motor Control Center lineups shall be provided as shown with the following ratings:
 1. Service: Voltage rating and number of wires shall be as shown on Drawings. Motor control center shall operate from a three-phase, 60 Hertz system.
 2. Wiring: NEMA Class II, Type B.
 3. Enclosure: NEMA 1.
 4. Interrupting Capacity Rating: Motor control center shall have an interrupting capacity rating above available fault current, as noted on the drawings. Devices shall be suitable for minimum rating noted.

5. Motor Control Center lineups shall be UL rated as suitable for service entrance where shown on Drawings and as required.

B. Construction:

1. Totally enclosed structure, dead front, consisting of nominal 20-inch deep, 20-inch wide, 90-inch high vertical sections bolted together to form a unit assembly.
2. Vertical sections shall have side sheets extending the full height and depth of section.
3. Removable lifting angles for each shipping section.
4. Two removable floor sills for mounting.
5. Horizontal wireways top and bottom, isolated from horizontal bus and readily accessible.
 - a. Wireway openings between sections shall have rounded corners and rolled edges.
6. Isolated vertical wireways with cable supports, accessible through hinged doors, for each vertical section.
 - a. Wireway shall be separate from each compartment and remain intact when compartment is removed.
7. All metal non conducting parts electrically continuous.

C. Bus System:

1. Rating: Bus bracing and bus current capacities above available fault current, as noted on drawings.
2. All bus bars tin plated copper rated UL heat rise standards.
3. Bus bar connections easily accessible with simple tools.
4. Main Horizontal Bus:
 - a. Continuous edge mounted, and isolated from wireways and working areas.
 - b. Bus shall be mounted in vertical center of motor control center to provide easy access and even heat distribution.
 - c. Bus shall be supported, braced, and isolated by a high strength, non-tracking, glass-filled polyester material.
5. Vertical Bus:
 - a. Continuous, and isolated by a glass polyester barrier.
 - b. Rated for 300 amperes continuous minimum, and at least equal to the full load rating of all installed units in the associated stack.
6. Grounding Bus: Full length mounted across the bottom, drilled with lugs of appropriate capacity as required.

D. Unit Compartments:

1. Provide individual front door for each unit compartment. Door shall be fastened to stationary structure, not the unit itself, so that door can be closed when unit is removed.
2. Starter and feeder unit doors interlocked mechanically with unit disconnect device to prevent unintentional opening of door while energized and unintentional application of

- power while door is open, with provisions for releasing interlock for intentional access and application of power.
3. Padlocking arrangement permitting locking disconnect device in the "OFF" position with at least three padlocks with door closed or open.
 4. Compartments shall be equipped as indicated on the Drawings:
 - a. Blank compartments, unused space, and compartments shown on Drawings as "SPACE" shall have bus covers and be complete with all necessary hardware for future installation of a plug-in unit.
 - b. Provide shutters for each compartment that automatically open when unit is inserted and automatically close when unit is removed.
 5. Provide wiring and device identification:
 - a. Identify compartment doors, devices, and field wiring in accordance with Section 16075, Electrical Identification.
 - b. Identify all internal control conductors with permanent type wire markers. Each wire shall be identified by a unique number attached to wire at each termination point.
 - c. Identify all internal control devices with permanent type markers. Each device shall be identified by a unique number attached to each device.
 - d. Numbering system for each wire and control device shall be identified on the wiring diagrams and shall reflect the actual designations used in the Work.
 6. NEMA 1 minimum motor starter size. Starter units completely draw out type in Sizes 1 and 2 and draw out type after disconnecting power leads only in Sizes 3 and 4.
 7. Motor starters shall be NEMA rated and include a magnetic contactor, with encapsulated magnet coils. Wound coils are unacceptable. All control shall be 120 volts AC unless noted otherwise.
 - a. Starters shall be full voltage non-reversing unless shown otherwise on Drawings.
 - b. Reduced Voltage Solid-State Starter:
 - 1) General:
 - a) Provide solid-state, step-less, current limiting, soft-start, motor controllers (RVSS) as shown on Drawings.
 - b) RVSS shall include an overload relay and an isolation contactor.
 - c) Provide subsystems that will protect RVSS from damage due to over-current and over-voltage.
 - d) Current Rating: 115 percent of motor nameplate rated current, continuous, minimum.
 - 2) Required Features:
 - a) Adjustable current limit of not more than 250 percent of motor nameplate full load current throughout entire motor acceleration period including first three cycles of voltage waveform from instant start signal is engaged.
 - b) Adjustable voltage acceleration, from 2 to 30 seconds.
 - c) Adjustable voltage deceleration, from 2 to 30 seconds.
 - d) Phase loss detection.
 - e) LED diagnostic indicators.
 - f) Static over-current and over-voltage trip.
 - g) Phase reversal, line or fuse loss, and under-voltage protection.
 - h) Power unit over temperature protection.

- i) Motor inverse time overload protection.
 - j) Input line transient over-voltage protection.
 - 3) Enclosure:
 - a) Cooling fans, if required, shall incorporate anti-friction bearings and internal impedance type motor protection.
 - b) If cooling fans are used, the enclosure for that section shall be NEMA 12 FVF, or NEMA 12 EFVFF force ventilated with filters, per NEMA Standard ICS1-110, installed by motor control center manufacturer.
 - 4) On start-up, start driven equipment at zero current and allow driven equipment to accelerate to maximum speed without exceeding the set current limit.
 - 5) On normal shutdowns, ramp driven equipment down at set deceleration rate that is non-regenerative for motor prior to shutdown.
 - 6) On emergency shutdowns, remove power to motor.
 - 7) Diagnostic LEDs: Provide LEDs on unit front that indicate the following:
 - a) Control power on.
 - b) Motor power on.
 - c) Motor starting.
 - d) Motor fault.
 - e) RVSS fault.
 - 8) Control Outputs:
 - a) Control output shall be electrically isolated, dry, normally open SPDT contacts, rated 10 amps at 120 volts AC.
 - b) Provide the following control outputs:
 - (1) Motor running.
 - (2) Motor fault.
 - (3) RVSS fault.
8. Overload Relays: Provide an overload relay for each motor starter. Overload relays shall be in accordance with the following:
- a. Electronic Overload Relays: Relays shall be electronic type. Electronic relays shall be multi-function, adjustable, current sensing type and include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.
 - b. Each overload relay shall be manual reset type and shall include provisions for resetting by an insulating button on front of starter unit door.
 - c. Each overload relay shall include a normally open auxiliary contact for remote alarm purposes.
 - d. Each overload relay shall be sized for full-load amperes and service factor of actual motors installed.
9. Individual control power transformers for all starters capacity as required for all control circuit devices, 100 VA minimum, Class A insulation, two primary fuses, 120 volt secondary, one secondary fuse, and the other secondary leg grounded.
10. Separate Control: Where control power to starter is provided by a separate power source, a control power fuse shall be provided in unit and main disconnect shall be equipped with a normally open contact to isolate control circuit from source when controller disconnect is open.
11. Motor horsepowers shown are per existing available documentation and shall be verified in field by Electrical Contractor to insure proper construction of new control

- units. Circuit breaker trips and starter overload heaters to be coordinated with the actual equipment installed.
12. Auxiliary contacts, relays, timers as required for specified control functions shall be verified in field by the Electrical Contractor's review of the existing starter units to insure new starter units construction offer the same operation of equipment.
 13. Current Sensing Devices:
 - a. Current Switch:
 - 1) Produces a dry contact output when load current exceeds set point.
 - 2) Suitable for use measuring current on motor leads of 480-volt, 60 Hertz., up to 150-amp continuous.
 - 3) Variable trip point and time delay. Trip point settable via calibrated dial.
 - 4) Monitors currents from 10 mA to 150 AC Amps
 - 5) Output relay (Form C) rated up to 20 amps
 - 6) LED trip status indicator
 - 7) Dead band prevents relay chatter
 - 8) Contact Material: Silver-cadmium oxide
 - 9) Mechanical Life: 10 million operations, typical at rated load
 - 10) Electrical Life: 100,000 operations, typical at rated load
 - b. Current Transducer:
 - 1) Produces 4 -20 mA DC output current proportional to the input average RMS AC motor load current.
 - 2) Loop powered
 14. All starter devices, including spare contacts, wired to numbered terminal blocks.
 15. Terminal blocks for field connections to unit compartments shall be plug-in/pull apart type. Terminals shall be fully accessible from the front. Terminals shall be mounted near the front of vertical wireway.
 16. Control devices shall be 600-volt heavy duty, NEMA A600. Relays shall have convertible contacts. Pilot devices shall be oiltight. Pilot lights shall be transformer type with six-volt secondary.
 17. Feeder Circuit Breakers: Thermal magnetic type.
 - a. Circuit breakers of 100-amp frame or less shall be mounted in a dual mount compartment (two breakers in one space factor) or shall mount in one-half space factor, unless otherwise indicated on Drawings.
 18. Motor Starter Circuit Breakers: Magnetic trip only motor circuit protectors.
 19. Provide the following diagrams and tables inside of door for each compartment:
 - a. Elementary wiring diagram.
 - b. Table of overload heater sizes with correct heater highlighted.
 - c. Table of motor circuit protector settings with correct setting highlighted.
 20. Where shown on Drawings, incorporate a solid state protective relaying package (SSPRP) into motor starter for motor protection. Unit shall incorporate the following ANSI C37.2 device function numbers and selectable indications and communication modules:
 - a. Product and Manufacturer:
 - 1) GE MultiLin SR469.
 - 2) Or equal.
 - b. Motor Protection Device Functions:

- 1) Stator winding over-temperature (Device 49).
- 2) Short circuit (Device 50).
- 3) Motor overload (Device 49/50/51).
- 4) Locked rotor - multiple start (Device 48).
- 5) Phase reversal (Device 46).
- 6) Ground fault (Device 50G/51G).
- 7) Mechanical jam.
- 8) Unbalance/negative sequence currents (Device 46).
- 9) Undercurrent (Device 37).
- 10) Motor bearing over-temperature (Device 38).
- 11) Thrust bearing over-temperature (Device 38).
- 12) Over-voltage (Device 59).
- 13) Undervoltage (Device 27).
- 14) Voltage sequence (Device 47).
- 15) Main trip and lockout output relay (Device 86).
- 16) Alarm output relay (Device 74).
- c. Selectable Indications:
 - 1) Average motor current.
 - 2) Average motor temperature.
 - 3) Motor current for each of the three phases.
 - 4) Motor temperature readout for six winding RTDs.
 - 5) Motor thrust-bearing temperature readout for two bearing RTDs.
 - 6) Ground fault current.
 - 7) Percent of motor capacity used.
 - 8) Line-to-line and line-to neutral voltages, all three phases.
 - 9) Average 15-minute kVA.
 - 10) Average 15-minute kW.
 - 11) Average 15-minute kVAR.
 - 12) Maximum percent full load current since initial startup.
 - 13) Hottest RTD and temperature since initial startup.
 - 14) Highest percent current unbalance since initial startup.
 - 15) Highest ground fault current since initial startup.
 - 16) Highest motor bearing temperature since initial startup.
 - 17) Highest load bearing temperature since initial startup.
 - 18) Maximum line voltage since start.
 - 19) Minimum line voltage since start.
 - 20) Number of motor starts attempted.
 - 21) Number of motor starts completed.
 - 22) Hours of operation.
 - 23) Number of trips from each of ten protective functions.
 - 24) All measured values at the time of a motor trip.
 - 25) Values that have been loaded for system inputs and trip points.
- d. Communication Module: RS232 capable of uploading all the above protective function attitudes and all the above listed selectable indications upon being queried by a host PLC hooked up through RS232 communication port.
21. Main and Tie Circuit Breakers: Thermal magnetic, molded case type, unless shown otherwise. Where shown, main and tie breakers shall be equipped with key interlocking. Interlocking shall allow only two of the three breakers to be closed at a time. Provide all locks and keys as required. Main circuit breakers shall be 100 percent

amperage rated. Circuit breakers with frame ratings 800 amps and greater shall be electronic type with adjustable parameters and ground fault protection.

E. Surge Protection Device (SPD) Unit:

- a. Provide an integral SPD unit for each motor control center. SPD unit shall comply with Section 16282, Surge Protection Device.

2.3 MAIN METERING DEVICE

A. Provide a main meter device as shown on Drawings.

1. Microprocessor based monitoring device shall provide complete electrical metering in one package. Device shall include self-contained potential transformers and self-protected internal fuses.
2. Device shall be mounted on compartment door to allow operator access to meter menu and display.
3. Device shall include trend analysis, event logging, and recording. Device shall also include the following direct reading metered values:
 - a. Volts: 0.2 percent accuracy
 - b. Amperes: 0.2 percent accuracy
 - c. Watts, Vars and VA: 0.5 percent accuracy
 - d. Power Factor: 1.0 percent accuracy
 - e. Frequency: 0.05 percent accuracy
 - f. Watt, and VA Hours: 0.5 percent accuracy
 - g. Var Hours: 1.0 percent accuracy
 - h. Watt, Var and VA Demand: 0.4 percent accuracy
 - i. THD-Voltage: 50th harmonic
 - j. THD-Current: 50th harmonic
 - k. Individual Ampere Harmonics: 50th harmonic
 - l. Individual Voltage Harmonics: 50th harmonic
4. Metering device shall have the following additional features:
 - a. Trend analysis that shall display minimum and maximum values for each metered parameter with date and time of each occurrence.
 - b. Input range of device shall accommodate external current transformers with ranges from 100/5 to 5000/5 and potential transformers from a ratio of 120:120 to 500,000:120. Three current transformers suitably rated shall be included.
 - c. Alarm contacts rated five amps at 120 VAC.
 - d. Three analog outputs programmable to reflect the metered parameters, except kilowatt hours and kilovar hours.
 - e. Communication capability, using RS-485, Modbus RTU Protocol.
5. Control power shall be drawn from monitored incoming AC line. Device shall have non-volatile memory and not require battery backup. During a power failure, device shall retain preset parameters.

2.4 SOURCE QUALITY CONTROL

- A. Perform factory tests on individual motor control units prior to shipment. Tests shall include manufacturer's standard tests, including:
 - 1. Physical inspection and checking of all components.
 - 2. Mechanical operation and device function tests.
 - 3. Primary, control, and secondary wiring hi-pot tests.
- B. Factory tests as outlined above shall be witnessed by the OWNER's representative:
 - 1. The manufacturer shall notify the OWNER two (2) weeks prior to the date the tests are to be performed.
 - 2. The manufacturer shall include the cost of transportation and lodging for up to three (3) OWNER's representatives.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions under which Work is to be installed and notify 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.
- B. Electrical Contractor shall verify and document all existing components and wiring terminations of each Motor control unit to be replaced within existing Motor Control Centers as shown on Drawings for proper construction of replacement control units.

3.2 INSTALLATION

- A. Install motor control centers on concrete bases in accordance with the Contract Documents and manufacturer's recommendations and instructions.
- B. Do not provide openings in top or side of motor control centers not required for conduit.
- C. Cable circuits together within enclosures and identify with durable tag secured to cabling twine.
- D. Set motor circuit protectors at lowest setting that allows motor starting without nuisance tripping.
- E. Verify that wiring diagrams on inside of door of each compartment reflect the circuitry actually provided and that correct overload heater size and motor circuit protector setting are noted.
- F. Install in conformance with the manufacturer's recommendations, governing codes, and the Contract Documents.
- G. Connections to existing facilities shall be coordinated with Owner's operations.

- H. Verify that all conductors, power and control, have been properly identified per specification section 16075.

3.3 FIELD QUALITY CONTROL

- A. Perform field testing and inspection of motor control centers. Inspect and test each motor control center after installation. All testing and inspection shall be in accordance with the manufacturer's recommendations and be performed by manufacturer's factory-trained representative, who shall inform OWNER and ENGINEER when equipment is correctly installed. Do not energize equipment without permission of OWNER.
- B. Perform the following minimum tests and checks before energizing equipment:
 - 1. Verify all overload and device settings.
 - 2. Inspect all mechanical and electrical interlocks and controls for proper operation.
 - 3. Check tightness of bolted connections.
 - 4. Measure insulation resistance of each bus section, phase-to-phase and phase-to-ground.
 - 5. Measure insulation resistance of each starter, phase-to-phase and phase-to-ground.
 - 6. Measure insulation resistance of each control circuit with respect to ground.
 - 7. Perform other tests recommended by equipment manufacturer.

3.4 MANUFACTURER SERVICES

- A. Manufacturer Services:
 - 1. Unloading and Installation: Manufacturer's factory-trained representative shall be present during unloading of the equipment and installation in the equipment's final location. Representative shall train installing personnel in advance in the proper handling and rigging of the equipment.
 - 2. Manufacturer's factory-trained representative shall test the system as specified in Article 3.3 of this Section. Representative shall operate and test the system in the presence of ENGINEER and verify that the equipment conforms to requirements.
 - 3. Manufacturer's factory-trained representative shall adjust the system to initial settings as specified in Article 3.5 of this Section.
 - 4. Representative shall revisit the Site as often as necessary until all deficiencies are corrected, prior to readiness for final payment.
 - 5. Provide services of manufacturer's factory-trained representatives to correct defective Work within 72 hours of notification by OWNER during the Correction Period specified in the General Conditions as amended by the Supplementary Conditions.
 - 6. Replacement parts or equipment installed during the Correction Period shall be equal to or better than the original.
- B. Training: Furnish services of qualified factory trained specialists from manufacturer to instruct OWNER's operations and maintenance personnel in recommended operation and maintenance of the products.

3.5 ADJUSTING

- A. Calibrate, set, and program all protective devices. Coordinate protective devices furnished under this Specification section and provide proper settings of all devices

END OF SECTION 262419

SECTION 262816 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches.
- B. Safety Disconnect switches

1.2 RELATED SECTIONS

- A. Section 260553 – Electrical Identification

1.3 REFERENCES

- A. NECA - Standard of Installation (published by the National Electrical Contractors Association).
- B. NEMA FU1 - Low Voltage Cartridge Fuses.
- C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association).
- E. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

- A. Follow requirements for submittals, procedures for submittals, in general project requirements.
- B. Product Data: Provide switch ratings and enclosure dimensions.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Record actual locations of enclosed switches in project record documents.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Follow requirements for material and equipment in general project requirements:

- Product options and substitutions.
- B. Cutler Hammer.
- C. Eaton
- D. Square D.
- E. Siemens Energy and Automation
- F. General Electric
- G. Substitutions: Engineer Approved Equal.

2.2 FUSIBLE SWITCH ASSEMBLIES

- A. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.
- B. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.
- C. Short Circuit rating: 200,000 amps

2.3 ENCLOSURES

- A. Fabrication: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1 or 12 as indicated on Drawings.
 - 2. Exterior Locations: Type 4X SS.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install fuses in fusible disconnect switches.
- C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

- A. Follow requirements for Starting of Systems in general project requirements: Field inspection, testing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION 262816

SECTION 262923 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, services, and incidentals as shown, specified, and required to furnish and install variable frequency drives, complete and operational.
2. Variable frequency drives required under this Section are low-voltage, voltage source inverter, pulse width modulated. Variable frequency drives shall be customized.

B. Where variable frequency drives are being provided by the vendor of the associated driven equipment, costs for variable frequency drives shall be included in the lump sum price for said equipment. Where variable frequency drives are not being provided by the vendor of the associated driven equipment, costs for variable frequency drives shall be included in the general contract price.

C. Related Sections:

1. Section 260553, Electrical Identification.
2. Section 260520, Shielded Cable.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. IEEE 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
2. NEMA AB 1, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
3. NEMA ICS 2, Industrial Control and Systems, Controllers, Contactors and Overload Relays Rated 600 Volts.
4. NEMA ICS 7, Industrial Control and Systems Adjustable Speed Drives.
5. NEMA MG 1, Motor and Generator Standard.
6. UL 508, Industrial Control Equipment.
7. ISO 9000, Quality Management Systems, Fundamentals and Vocabulary.
8. ISO 9001, Quality Management Systems, Requirements.
9. ISO 9002, Quality Systems, Model for Quality Assurance in Production, Installation and Servicing.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:

- a. Variable frequency drive manufacturer shall have at least five years of experience designing and regularly manufacturing and servicing substantially similar equipment to that specified, and shall submit documentation upon request of at least five installations in satisfactory operation for at least five years.
- b. Manufacturer shall be certified under ISO 9000, ISO 9001, or ISO 9002 for materials and equipment specified.
- c. For all required factory tests, variable frequency drive manufacturer shall use a factory test facility that has calibrated its testing apparatus in the previous twelve months, and is staffed by qualified, experienced technicians.

B. Component Supply and Compatibility:

1. Drives specified under this Section shall employ a low switching frequency or pattern to minimize instantaneous rate of voltage change over time (dv/dt), and the adverse effects of potential bearing currents. Where alternate manufacturers are proposed, obtain manufacturer recommendations regarding bearing currents and provide equipment required at no additional cost to OWNER.
2. Each variable frequency drive shall be totally compatible with associated driven equipment and motors. Variable frequency drives shall be matched to specific load requirements for each system. Operation of variable frequency drive shall not overstress motor insulation.
3. Similar components of drives associated with each system shall be products of a single manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
 - a. Dimensional information and construction details of enclosures. Enclosure details shall consist of exterior and interior front door with nameplate legends, interior door front and rear views, and terminal block layout.
 - b. Three-line power and control schematic diagrams.
 - c. Wiring diagrams showing the interconnection of conductors to all devices with terminal assignments for remote devices.
 - d. Functional description of system operation.
 - e. VFD heat dissipation at full load, including heat rejection/cooling system.
 - f. Preliminary Harmonic analysis shall utilize:
 - 1) I_L shall be 80% of the connected load.
 - 2) The point of common coupling (PCC) shall be the first main breaker of the motor control center which the VFD is powered from.
 - 3) The level of harmonics, at the PCC described above, shall not exceed IEEE 519 limits.
2. Product Data:
 - a. Technical specifications.
 - b. Catalog cuts and product literature.
3. Testing Plans:

- a. At least thirty days prior to source quality control testing, submit descriptions of proposed shop testing methods, procedures, and apparatus.
- b. At least thirty days prior to field quality control testing, submit descriptions of proposed field testing methods, procedures, and apparatus.

B. Informational Submittals: Submit the following:

1. Certificates:

- a. Certification letters from variable frequency drive manufacturer and motor manufacturer that the approved driven equipment has been reviewed and that variable frequency drive units and motors are compatible, and shall be provided in accordance with the Contract Documents and requirements of the driven equipment.

2. Source Quality Control Submittals:

- a. Within 14 days of completing source quality control tests and inspections, submit test results with indication of whether all criteria of the Contract Documents for the specified equipment were met.

3. Field Quality Control Submittals:

- a. Within 14 days of completing field quality control tests and inspections, submit test results with indication of whether all criteria of the Contract Documents for the specified equipment were met.

4. Manufacturer Reports:

- a. Preliminary and final harmonic analysis.
- b. Within 14 days of each visit to the Site by manufacturer's representative, submit written report of reason for visit, problems encountered, solutions implemented, and remaining work.

5. Qualifications Statements:

- a. Manufacturer.

C. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data:

- a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, list of recommended spare parts, and spare parts ordering information.
- b. Manuals shall include record drawings of control schematics, including point-to-point wiring diagrams.
- c. Comply with Section: Operation and Maintenance Data.
- d. Field report of final harmonic testing.

D. Maintenance Materials Submittals: Submit the following:

1. Spare Parts and Extra Stock Materials:

- a. Furnish, tag, and box for shipment and long term storage, spare parts and special tools for variable frequency drives. Each spare part set shall include manufacturer's recommended spare parts inventory for one year and include, at minimum, the following:

Item	Quantity per Four VFDs per HP Rating
1) Transistor and diode modules with accessories	One set
2) Power supply module	One
3) Fans	One set
4) Power fuses	One set of each size and type used
5) Control power fuses	Two sets of each size and type used
6) Pilot lights	Two per ten of each type used

2. Furnish a list of recommended spare parts for an operating period of one year. Describe each part, the quantity recommended, and current unit price.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Shipping containers shall be designed to be shipped by truck, rail, or ship. Indoor containers shall be bolted to skids.
3. Inspect variable frequency drive equipment for shipping damage or loose parts upon delivery. Check for evidence of water that may have entered equipment during transit.

B. Handling:

1. Lift, roll or jack variable frequency drive equipment into locations shown.
2. Variable frequency drives shall be equipped for handling required for installation. Handle equipment in accordance with manufacturer's requirements.

C. Storage:

1. Store variable frequency drive equipment in a clean, dry location with controlled, uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

PART 2 - PRODUCTS

2.1 EQUIPMENT PERFORMANCE

A. System Performance:

1. Driven equipment to be controlled by a variable frequency drive shall be provided with a customized variable frequency drive. Each drive unit shall include an adjustable frequency controller with associated controls for continuous speed adjustment and protection of the driven equipment. Output speed control of motor shall be continuous throughout speed range of two to 60 Hertz under variable torque load or constant torque as specified for the driven equipment.
2. Variable frequency drives associated with each set of driven equipment shall be similar to each other.
3. Variable frequency drives shall be UL-listed or ETL-listed and designed, built, and tested in accordance with NEMA AB 1, NEMA ICS 2, NEMA ICS 7, and UL 508.
4. The VFD shall not emit harmonics that exceed IEEE 519 limits at the PCC.
5. The point of common coupling for all VFDs to be tested and conform to IEEE 519 harmonic limits will be considered the first point of connection to the electrical system, be that the motor control center that the VFD power is being supplied from and not the utility connection point.

2.2 MANUFACTURERS

- A. Provide variable frequency drives by one of the following:

1. Schneider Electric
2. ABB
3. Allen-Bradley
4. Eaton
5. Toshiba
6. Danfoss
7. Or equal.

2.3 APPROVED EQUAL: OTHER MANUFACTURERS MUST BE PRE-QUALIFIED BEFORE ONE (1) WEEK PRIOR TO BID OPENING. PREQUALIFICATION SHALL CONSIST OF SUBMITTING INFORMATION LISTED IN PARAGRAPHS 1.3 AND 1.4 ABOVE TO THE ENGINEER A MINIMUM OF TWO (2) WEEKS PRIOR TO THE BID OPENING DATE. APPROVAL OF EQUAL MANUFACTURERS (IF ANY) WILL BE MADE BY ADDENDUM PRIOR TO THE BID OPENING.

- A. Provide each variable frequency drive with freestanding or wall hanging, front-access, NEMA 1, filtered and gasketed enclosure. Enclosure shall house all components required for the associated variable frequency drive.
- B. Enclosure shall provide adequate cooling for components within and include positive ventilation.
- C. Enclosure shall include circuit breaker disconnect switch. Circuit breakers shall be in accordance with NEMA AB 1. Switch handle shall be suitable for padlocking and be through-the-door type with handle height not exceeding six feet. Operation of switch shall remove the service supply from all internal components. Power devices shall be suitable for interrupting capacity matching that of the upstream Power source in symmetrical amperes. Include current limiting semi-conductor fuses where required for protection of solid state components.

- D. Enclosure door shall include an operator interface for access to controller's digital keypad and display.
- E. Equip enclosure front with nameplates for identification of equipment and operating functions. Nameplates shall be in accordance with Section 16075, Electrical Identification.
- F. Equip enclosure with phenolic type terminal blocks suitably labeled for all internal and remote wiring requirements, plus twenty percent spare.
- G. Data shall be formatted as required to communicate with the plant SCADA system. The VFD's shall communicate via-Ethernet TCP/IP. The manufacturer shall coordinate with the plant integrator to map data for SCADA interface.

2.4 ADJUSTABLE FREQUENCY CONTROLLER

A. General:

- 1. Adjustable frequency controller shall be microprocessor-based, pulse width modulated design, suitable for operation on a 480-volt, three-phase supply. Controller shall produce an adjustable AC voltage/frequency output to vary speed of driven equipment. Controller shall consist of the following sections:
 - a. The drive shall be a PWM (Pulse Width Modulated) inverter using IGBT transistors.
- 2. Controller switching frequency shall be adjustable and allow operation at 5,000 Hertz or less. Controller technology shall include a switching scheme that reduces the dv/dt of output supply.
- 3. Equip controller with a DC bus reactor or input line reactor as required to keep equipment line harmonics to a minimum.
- 4. Controller's solid state converter input section switching devices shall have 1600 volt PIV rating.
- 5. Overload rating of 110 percent variable torque, 150 percent constant torque for one minute.
- 6. RMS harmonic content of output current shall be less than five percent of fundamental current.
- 7. Able to withstand output terminal line-to-line short circuits without component failure.

B. Operating Criteria:

- 1. Operating criteria shall be in accordance with the following:
 - a. Ambient temperature range of zero to 40 degrees C.
 - b. Operational humidity of up to 90 percent non-condensing.
 - c. Altitude up to 3,300 feet above sea level.
 - d. Nominal voltage of 480-volts plus or minus ten percent, three-phase, three-wire. Include an under-voltage feature to allow trip-free operation down to 35 percent undervoltage.
 - e. Nominal frequency of 60 Hertz plus or minus three Hertz.
 - f. Input power factor of 95 percent displacement power factor at all operating speeds.
 - g. Efficiency of 96 percent at full speed and full load.

C. Features:

1. Controller shall have the following features:

- a. Digital keypad and display module shall provide parameter setting, adjustments, and monitoring of control functions and faults. Display messages shall be in English.
- b. Serial communication port shall allow connecting to programmable controller interface using manufacturer standard protocol.
- c. Independent acceleration/deceleration rates shall provide two to 600 seconds minimum. When called to stop, motor shall decelerate to minimum speed before stopping.
- d. Power loss feature shall allow five cycle ride through capability for input supply interruptions.
- e. Time delay automatic restart shall allow restart after controller fault conditions have been cleared with programmable attempts.
- f. Coasting motor restart shall allow controller to restart into a coasting motor without damage or tripping. Coasting motor restart feature shall allow switching from bypass mode to variable frequency drive mode while operating, without shutdown.
- g. Isolated control inputs and outputs.

D. Protection:

1. Controller shall have protective functions as follows:

- a. Input line metal oxide varistor transient protection.
- b. Electronic over-current trip, instantaneous and inverse time overload protection with thermal memory retention.
- c. Over-temperature trip temperature protection.
- d. Current limit trip protection.
- e. Input line over- and under-voltage trip protection.
- f. Ground fault trip protection.

2. Power Line Considerations:

- a. The drive shall be designed to operate in accordance with all performance requirements of the contract documents from a power source which contains a maximum of 5% total Voltage harmonic distortion, meet current distortion as defined by IEEE-519-1992.
- b. Each VFD or multiple sets of VFD's shall be designed and installed such that: the total voltage harmonic distortion reflected back to the power source is a maximum of 5%.
- c. When required line reactors and harmonic filters are required, they shall be provided by VFD supplier and shall be rated for, and compatible with, each VFD. They shall function as a complete system. Additional harmonic filters beyond those shown on drawings may be required in order to comply with the above parameters. The line reactors and harmonic traps shall be mounted inside the respective VFD enclosures. Traps shall be fuse-protected as a minimum and

shall protect internal wiring and components on each phase and shall be current limiting. Data on these items shall be included with VFD shop drawings.

- d. The VFD supplier shall perform a computer simulated power system study to verify compliance with the parameters as stated herein. The results of this study shall be submitted to the engineer. At a minimum the submitted results of this study shall include:
 - 1) A results summary sheet which briefly describes the power system configuration analyzed and which states the calculated values of total harmonic distortion.
 - 2) Detailed list of the amplitude of harmonic currents and voltages to the 50th harmonic.
 - 3) This report must show if IEEE 519 is met and where on the power distribution.
- e. The contractor shall supply the VFD supplier with all power system data required to perform the above described study. These data may include but are not limited to:
 - 1) A complete one-line diagram of the subject electrical distribution system.
 - 2) Complete electrical data on all equipment shown on the one-line diagram is required. At a minimum this data shall consist of:
 - a) Transformers - kVA, Primary voltage, Secondary voltage, Short circuit capacity or impedance.
 - b) Motors - Horsepower, Base speed, Full load RMS current (FLA).
 - c) Generators - Short circuit capacity or Subtransient reactances (X_d), Power factor, kW, X/R Ratio.
 - 3) If the distribution system can function in more than one configuration, the configuration(s) to be analyzed shall be clearly defined. Any other information which may affect the behavior of the distribution system shall also be provided.

2.5 OUTPUT FILTER

A. General:

- 1. Provide output filter to prevent overstressing motor insulation system. Provide output filter with each variable frequency drive, when cable length between motor and variable frequency drive exceeds the following based on noted switching frequencies.
 - a. One KHZ switching frequency, 200 feet cable length.
 - b. Three KHZ switching frequency, 175 feet cable length.
- 2. Provide output filters in all other cases, based on recommendations of variable frequency drive and motor manufacturers, when actual voltage peaks at motor terminals exceed NEMA MG 1 limits.

B. Features and Criteria:

- 1. Filter shall be three-phase, 600-volt class motor-protecting type consisting of suitable values of inductance, capacitance and resistance to form a damped, low pass filter.

2. Filter shall be low-loss type specifically designed to reduce voltage wave form dv/dt . Filter shall allow cable lengths at minimum exceeding actual application distances with waveform resulting in voltage spikes at motor terminal that are within NEMA MG 1 Part 31 voltage stress levels.
3. Filter shall be suitable for mounting within variable frequency drive enclosure.

2.6 CONTROLS

A. General:

1. Equip each variable frequency drive control system with relays, switches, fuses, indicating lights, and components required for a complete, functional system.
2. Variable frequency drive control shall be powered from a suitably sized and protected control power transformer.
3. Variable frequency drive control shall include status indicators, controller, and system fault condition displays and operating controls. Provide status indicators and operating controls associated with drive control on front door of enclosure.
4. Control arrangement shall be such that variable frequency drive internal electronic supply voltage is isolated from field wiring.

B. Control and Pilot Devices:

1. Relays shall be standard, latching type, and pneumatic or solid state time delay type. Provide relays with contacts rated ten amps, quantity as required.
2. Pilot devices shall be heavy duty type, rated 10 amps continuous. Indicating lights shall be push-to-test transformer type with 12-volt secondaries.

C. Operation:

1. Controls for each variable frequency drive shall consist of all devices necessary for the following:
 - a. Stop/Start and Speed Control: Stop/start and speed control shall respond to drive-mounted selector switch. With switch in "REMOTE" position, stop/start and speed control shall be based on a stop/start contact and four- to 20-mADC speed signal from remote process control panel. With switch in "LOCAL" position, stop/start control shall be based on remote stop/start pushbuttons located adjacent to driven equipment, and speed control shall be based on drive-mounted speed potentiometer.
 - b. Emergency Stop Control: Emergency stop control shall respond to remote stop pushbutton located adjacent to driven equipment. When activated, driven equipment shall stop immediately in all operating modes.
 - c. Motor Over-temperature Shutdown: Motor over-temperature control shall respond to remote contact that activates on motor over-temperature. When over-temperature is detected, driven equipment shall stop. Include provisions to remotely supply 120-volt power to thermistor control module located at motor.
 - d. Seal water control (required for pumps and other equipment that require seal water): Seal water control shall include provisions to supply 120-volt power to remote seal water solenoid. Seal water solenoid shall energize when equipment requiring seal water is enabled. Equipment requiring seal water start shall be

delayed until remote-located pressure switch verifies seal water flow. Upon loss of seal water, after an adjustable period of time, an alarm shall be initiated but equipment requiring seal water shall not shut down. When equipment requiring seal water is stopped, seal water solenoid shall remain energized for an adjustable period of time.

D. Auxiliary Features:

1. Provide each variable frequency drive with the following:
 - a. Status Indicators: Status indicators shall include separate pilot lights for indication of motor run (red), and bypass mode (blue).
 - b. Shutdown Indicators: Shutdown indicators shall include separate pilot lights (amber) for each shutdown condition. Arrange shutdown indication circuitry so that, when activated, indicator requires manual reset.
 - c. Contact Outputs: Contact outputs shall include separate dry contacts for remote indication of motor run, seal water alarm for equipment with seal water systems, each shutdown condition, and controller faults.
 - d. Speed Output: Speed output shall include four- to 20-mADC signal for remote indication of motor speed.

E. Wiring and Device Identification:

1. Provide control wiring and device identification for each variable frequency drive:
 - a. Identify all control conductors with permanent type wire markers. Each wire shall be identified by a unique number and shall be attached to wire at each termination point.
 - b. Identify each control device with permanent type marker. Each device shall be identified by a unique number and shall be attached to each device.
 - c. Numbering system for each wire and control device shall be identified on wiring diagrams and shall reflect actual designations used in the Work.

2.7 SOURCE QUALITY CONTROL

A. Tests:

1. Perform factory tests on each variable frequency drive prior to shipping. Test shall consist of simulating expected load to be driven by operating load through speed ranges specified for driven equipment, for minimum of two hours per drive unit.
2. Provide factory control and alarm tests on each drive unit by simulating each control signal and each alarm function to verify proper and correct drive unit action.
3. Perform specified tests in addition to standard factory tests typically performed.

B. Factory tests as outlined above shall be witnessed by the OWNER's representative:

1. The manufacturer shall notify the OWNER two (2) weeks prior to the date the tests are to be performed.
2. The manufacturer shall include the cost of transportation and lodging for up to three (3) OWNER's representatives.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions under which the Work will be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install equipment in accordance with manufacturer's recommendations and instructions and in conformance with Laws and Regulations, and the Contract Documents.
- B. Unless otherwise shown or indicated, install equipment at existing location of drive unit being replaced.
- C. Install equipment with sufficient access and working space provided for ready and safe operation and maintenance.
- D. For installations against masonry walls, provide an insulation board, 1/4-inch minimum thickness, between equipment and wall for corrosion protection. Trim board neatly within outline of equipment.
- E. Install all terminations, lugs, and required appurtenances necessary to properly terminate power supplies.
- F. Install control wiring terminations and appurtenances necessary to complete installing control and monitoring devices.

3.3 FIELD QUALITY CONTROL

- A. Site Tests:
 - 1. After installation, inspect, adjust, and test each variable frequency drive at the Site. Testing and inspection shall be in accordance with manufacturer's recommendations and be performed by manufacturer's factory-trained representative. Through CONTRACTOR, manufacturer's factory-trained representative shall inform OWNER and ENGINEER when equipment is correctly installed and ready to be energized. Do not energize equipment without permission of OWNER.
 - 2. Perform the following equipment inspection and testing and provide reports documenting procedures and results.
 - a. Verify all device settings and drive adjustments.
 - b. Inspect all mechanical and electrical interlocks and controls for proper operation.
 - c. Test each drive through specified speed ranges and loads for a minimum of two hours per drive unit.
 - d. Test each drive by using actual control signal for remote and local operation.
 - e. Test each drive alarm function.
 - f. Perform other tests recommended by equipment manufacturer.
 - g. Perform Harmonics testing to confirm compliance with IEEE 519 limits.

- 1) Testing of the Harmonic limits shall be per a VFD system as operating under natural conditions.
- 2) Utilize the recorded maximum current recorded for the operating VFD system as I Load.
- 3) Submit all calculations, all collected field data and graphs for review to Engineer.
- 4) If the VFD system fails to be at or below any or all of the IEEE 519 Harmonic acceptable levels the VFD manufacturer shall incur all costs associated with retesting, additional harmonic mitigation equipment, equipment installation and retesting expenses including costs associated with Engineer travel to witness any and all testing.

B. Manufacturer Services:

1. Unloading and Installation: Manufacturer's factory-trained representative shall be present during unloading of equipment and installation at equipment's final location. Representative shall train installing personnel in advance in the proper handling and rigging of equipment. Services by manufacturer's representative under this paragraph shall be at least 2 eight-hour days at the Site.
2. Post-installation Check: Manufacturer's factory-trained representative shall check and approve the installed equipment before initial operation. Manufacturer shall calibrate, set and program variable frequency drives provided. Services by manufacturer's representative under this paragraph shall be at least 2 eight-hour days at the Site. Manufacturer's factory-trained representative shall adjust the system to final settings as specified in Article 3.5 of this section. Manufacturer's factory trained representative shall test as specified in section 3.3.A of this section. Representative shall operate and test the system in presence of ENGINEER and verify that equipment is in conformance with the Contract Documents. Services by manufacturer's representative under this paragraph shall be at least 2 eight-hour days at the site.
3. Representative shall revisit the Site as often as necessary until all deficiencies are corrected, prior to readiness for final payment.
4. Provide services of manufacturer's factory-trained representatives to correct defective Work within 72 hours of notification by OWNER during the correction period specified in the General Conditions as may be amended by the Supplementary Conditions.
5. Replacement parts or equipment provided during the correction period shall be equal to or better than original.
6. Training: Provide services of qualified factory trained specialists from manufacturer to instruct OWNER's operations and maintenance personnel in recommended operation and maintenance of equipment.

3.4 ADJUSTING

- A. Following Substantial Completion, when inspection and testing are complete and variable frequency drives are operating, manufacturer's representative shall return to the Site and make final adjustments as required to each variable frequency drive furnished under this Section.

END OF SECTION 262923

SECTION 263213.16 - NATURAL GAS ENGINE GENERATOR SETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Packaged engine generator set.
- B. Exhaust silencer and fittings.
- C. Fuel fittings.
- D. Remote control panel.
- E. Battery and charger.

1.2 RELATED SECTIONS

- A. Enclosed Transfer Switch

1.3 REFERENCES

- A. NEMA AB1 - Molded Case Circuit Breakers.
- B. NEMA MG1 - Motors and Generators.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum.)
- D. NFPA 70 - National Electrical Code.
- E. NFPA 101 - Life Safety Code.
- F. NFPA 110 - Emergency and Standby Power Systems.
- G. IEC8528 part 4
- H. IEEE446

1.4 SUBMITTALS

- A. Submit as per the Contract requirements.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions,

fuel consumption rate curves at various loads, ventilation and combustion air requirements, Electrical diagrams including schematic and interconnection diagrams. Identify by terminal number each required interconnection between generator, the transfer switch, alarm panel, and other remote devices.

- C. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank.
- D. Test Reports: Indicate results of performance testing.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- F. Manufacturer's Field Reports: Submit as per the Contract requirements.
- G. Manufacturer's Field Reports: Indicate procedures and findings.

1.5 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Include instructions for normal operation.
- B. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 110.
- B. Maintain one copy of document on site.
- C. Testing
 - 1. Manufacturer and/or local representative shall be responsible for design prototype tests, final production tests, and site tests.
 - 2. Provide test reports to indicate all tests performed and all test results.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, and with service facilities within 100 miles of Project.
- B. Supplier: Authorized distributor of specified manufacturer with minimum five years documented experience.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, NFPA 110, and NFPA 101 and applicable local codes and regulations.
- B. Furnish Products listed and classified by Underwriters Laboratories testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.9 GENERAL REQUIREMENTS

- A. Generator system shall be tested during design verification, in production, and at Job site.
- B. The generator set shall be of commercial design and shall be complete with all necessary accessories for a complete installation as shown on plans and specifications.
- C. All equipment shall be new and of current manufacturer of generator sets and Controls, transfer switches, and switchgear and assembles the generator set as a complete and coordinated system with one-source warranty on parts and service.

1.10 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Accept unit on site on skids. Inspect for damage.
- B. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.12 WARRANTY

- A. Provide two-year comprehensive manufacturer warranty or 2000 hours whichever occur first from date of initial startup. This includes all parts labor and travel.

1.13 MAINTENANCE SERVICE

- A. Furnish service and maintenance of engine generator for one year from Date of Substantial Completion.

1.14 MAINTENANCE MATERIALS

- A. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.

1.15 EXTRA MATERIALS

- A. Provide two spares of each fuel, oil and air filter element.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Kohler
- B. Caterpillar
- C. Generac
- D. Cummins

2.2 ENGINE

- A. Type: Liquid-cooled turbo charged.

- B. Fuel System: Natural Gas
- C. Engine speed: 1800 rpm.
- D. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.
- E. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- F. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.
- G. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C). Radiator air flow restriction 0.5 inches of water (1.25 Pa) maximum.
- H. Engine Accessories: Lube oil filter, dipstick, oil drain, oil pump, intake air filter, lube oil cooler, gear-driven water pump. Include water temperature gauge and lube oil pressure gauge on engine/generator control panel
- I. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

2.3 GENERATOR

- A. Generator: NEMA MG1, three phase, reconnectable brushless synchronous generator with brushless exciter. The generator shall withstand at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit.
- B. Generator to be rated for 300KW/375KVA, 277/480 Volt, 3 phase, 4 wire, Stand-By duty with 130 degrees Celsius rise and be capable of supplying at least 1700 SKVA with no more than 35% voltage drop for motor starting.
- C. Insulation Class: NEMA MG-1-1.66, Class H, Synthetic, nonhygroscopic.
- D. Temperature Rise: 130 degrees C Standby.
- E. Enclosure: NEMA MG1, open drip proof.
- F. Voltage Regulation: Include generator-mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus .25 percent from no load to full load. Include manual controls to adjust voltage droop, voltage level (plus or minus 5 percent) and voltage gain.

2.4 ACCESSORIES

- A. Gas regulator, pressure reducer, metal braded flexible hose connector.
- B. Gas pressure requirements: 7-11 inches H₂O at generator final connection point; confirm 100% load natural gas consumption with vendor.
- C. Exhaust Silencer: Critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions. Exhaust noise shall be attenuated by 25 to 35 dba.
- D. Engine Jacket Heater: Thermal circulation type 1500-watt water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C), and suitable for operation on 120 volts AC.

- E. Batteries: Heavy duty, lead-acid storage batteries. Match battery voltage to starting system. Include necessary cables and clamps.
- F. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.
- G. 65-amp battery charging alternator Min.
- H. 12- or 24-volt DC output battery charger located in generator housing.
- I. 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40oC to +60oC, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.
- J. Line Circuit Breaker: 100% rated 450A NEMA AB 1, molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, min. AIC 42 KA, sized in accordance with NFPA 70. Unit mounted in enclosure to meet NEMA 250, Type 1 requirements.
- K. Engine-Generator Control Panel: NEMA 250, Microprocessor based Type 1 control panel enclosure with engine and generator controls and indicators. Include the following equipment and features:
 - 1. Frequency Meter: 45-65 Hz. range, 3.5-inch dial.
 - 2. AC Output Voltmeter: 3.5-inch dial, 2 percent accuracy, with phase selector switch.
 - 3. AC Output Ammeter: 3.5-inch dial, 2 percent accuracy, with phase selector switch.
 - 4. Output voltage adjustment.
 - 5. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
 - 6. Engine start/stop selector switch.
 - 7. Engine running time meter.
 - 8. Oil pressure gauge.
 - 9. Water temperature gauge.

10. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
 11. Additional visual indicators and alarms as required by NFPA 110.
 12. Remote Alarm Contacts: Pre-wire DPDT contacts to terminal strip for remote alarm functions required by NFPA 110 as specified (dry contact kit).
- L. Remote Annunciator Panel: Surface mounted panel with brushed stainless steel. Provide alarm horn, and indicators and alarms as follows:
1. High battery voltage (alarm).
 2. Low battery voltage (alarm).
 3. Low fuel pressure (alarm).
 4. System ready.
 5. Anticipatory-high water temperature.
 6. Anticipatory-low oil pressure.
 7. Low coolant temperature.
 8. Switch in off position (alarm).
 9. Overcrank (alarm).
 10. Emergency stop (alarm).
 11. High water temperature (alarm).
 12. Overspeed (alarm).
 13. Low oil pressure (alarm).
 14. Line power available.
 15. Generator power available.
 16. Lamp test and horn silence switch.
- M. Weather-protective, sound attenuated Enclosure: Reinforced steel housing allowing access to control panel and service points, with lockable doors and panels. Include fixed louvers, battery rack, silencer. Total Sound value 70 dB(A)@23 ft.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Control panel shall be installed to provide convenient access to panel controls. Having to physically enter the enclosure or climb over fuel tank to operate the control panel controls is not acceptable.
- C. Actual 100% load gas consumption and pressure requirements shall be verified and co-coordinated with the gas supplier. Any changes required due to an increase in gas usage or pressure requirements of the machine shall be included in this item at no additional cost to the owner.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed as per the Contract requirements.
- B. Provide full load test utilizing portable test bank for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.
 - 1. Perform a step load change of at least 75% of rated load.
- C. Record in 20-minute intervals during four-hour test:
 - 1. Kilowatts.
 - 2. Amperes.
 - 3. Voltage.
 - 4. Coolant temperature.
 - 5. Frequency.
 - 6. Oil pressure.

- D. Test alarm and shutdown circuits by simulating conditions.
- E. Engine generator fuel for testing shall be provided for in this section.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems as per the Contract requirements. The manufacturer's distribution representative shall perform an installation check, startup and load bank testing
- B. Provide two (2) year maintenance service on generator system. Provide normal consumable materials during this period.
- C Load Bank test- 2-hour resistive load bank test shall be performed. Data shall be recorded every 15 minutes for first hour with 25%, 50%, 75% and last hour 100% load. The temporary portable load bank will be provided by generator manufacturer

3.4 ADJUSTING

- A. Adjust generator output voltage and engine speed.

3.5 CLEANING

- A. Clean engine and generator surfaces. Replace oil filter.

3.6 DEMONSTRATION

- A. Provide systems demonstration.

- B. Describe loads connected to standby system and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide standby power.

END OF SECTION 263213.16

SECTION 263600 - ENCLOSED TRANSFER SWITCH

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Automatic transfer switch.

1.2 RELATED SECTIONS

- A. Section 263213 - Packaged Engine Generator Systems.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NEMA ICS 1 - General Standards for Industrial Control and Systems.
- C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- E. UL 1008 - Standard for Transfer Switch Equipment

1.4 SUBMITTALS

- A. Submit under provisions of Section 013323.
- B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions when engine generator is running.
- B. Maintenance Data: Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 016600.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Russelectric
- B. ASCO
- C. Kohler
- B. Cummins
- C. Cutler – Hammer
- D. Siemens

- E. Lake Shore Electric

2.2 AUTOMATIC TRANSFER SWITCH

- A. Description: NEMA ICS 2, automatic transfer switch.
- B. Configuration: Electrically operated, mechanically held transfer switch.
- C. Type: Dual mechanism, with off position, adjustable transfer delay, and manual operation of both sets of contacts using a handle.

2.3 RATINGS

- A. Voltage: 480 volts, three phase, four wire, 60 Hz.
- B. Switched Poles: 3. Refer to NEC Article 250 for proper generator grounding.
- C. Load Inrush Rating: Combination.
- D. Continuous Rating: 800 amperes.
- E. Withstand Current Rating: A minimum of 22 kA rms symmetrical amperes.
- F. Non service Entrance Rated without overcurrent protection

2.4 PRODUCT OPTIONS AND FEATURES

Microprocessor logic,
Adjustable time Delay Normal to Emergency
Adjustable time Delay Engine Start Adj. .5-15 secs.
Adjustable time Delay Emergency to Normal
Adjustable time Delay Engine Cooloff
Emer. Source Sensing:
Test pushbutton
Electrical Operator Isolation Switch
Single Phase Under Volt/Under Freq.
Indication / Pilot Light: Normal Position
Indication / Pilot Light: Emergency Position
Indication / Pilot Light: Normal Tripped
Indication / Pilot Light: Emergency Tripped
Aux. Contacts: Norm Source Avail. 4NO/4NC
Aux. Contacts: Emer Source Avail. 4NO/4NC
Normal and Emergency Over current protection
Auto. Plant Exer.: Selectable Load/No Load w/Failsafe

- A. Test Switch: Mount in cover of enclosure to simulate failure of normal source.
- B. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
- C. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed.
- D. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.
- E. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.
- F. Open transition transfer.

2.5 AUTOMATIC SEQUENCE OF OPERATION

- A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
- B. Time Delay to Start Alternate Source Engine Generator: 0 to 15 seconds, adjustable.
- C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
- D. Time Delay Before Transfer to Alternate Power Source: 0 to 3 minutes, adjustable.
- E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
- F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.
- G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.
- H. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.
- I. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

2.6 ENCLOSURE

- A. Enclosure: NEMA Type 1
- B. Finish: Painted Steel.

- C. Free Standing, to be bolted to concrete below
- D. Front Access only.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install transfer switches in accordance with manufacturer's instructions.
- B. Provide engraved plastic nameplates under the provisions of Section 260553.
- C. Include startup by authorized technician and coordinate with generator manufacturer.

3.2 WARRANTY- Provide 5-year comprehensive warranty with parts, labor and travel

3.3 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 017900.
- B. Demonstrate operation of transfer switch in normal and emergency modes.

END OF SECTION 263600

SECTION 264313 - TRANSIENT VOLTAGE SUPPRESSION

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 TVSSs for low-voltage power, control, and communication equipment.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283.
 - 2. UL 1449.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports, including 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. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. 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.
- D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

1.6 PROJECT CONDITIONS

- A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within 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. Replaceable Protection Modules: One of each size and type installed.

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. Advanced Protection Technologies, Inc.
 2. Atlantic Scientific.
 3. Current Technology, Inc.
 4. Cutler-Hammer, Inc.; Eaton Corporation.
 5. Entrelec International.
 6. General Electric Company.
 7. Innovative Technology, Inc.
 8. Intermatic, Inc.
 9. LEA International.
 10. Leviton Mfg. Company Inc.
 11. Liebert Corporation; a division of Emerson.
 12. Northern Technologies, Inc.
 13. Siemens Energy & Automation, Inc.
 14. Square D; Schneider Electric.
 15. Surge Suppression Incorporated.
 16. Sutton Designs Inc.
 17. Transtector Systems, Inc.
 18. Tycor; Cutler-Hammer, Inc.
 19. United Power Corporation.
 20. Zero Surge Inc.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
 7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 8. LED indicator lights for power and protection status.
 9. Audible alarm, with silencing switch, to indicate when protection has failed.
 10. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 11. Surge-event operations counter.

- C. Peak Single-Impulse Surge Current Rating: 240 kA per phase.
- D. Connection Means: Permanently wired.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480/277, 3-phase, 4-wire circuits shall be as follows:
 - 1. Line to Neutral: 800V for 480/277.
 - 2. Line to Ground: 800 for 480/277.
 - 3. Neutral to Ground: 800 for 480/277.

2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
 - 1. LED indicator lights for power and protection status.
 - 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
 - 1. Fuses, rated at 200-kA interrupting capacity.
 - 2. Fabrication using bolted compression lugs for internal wiring.
 - 3. Integral disconnect switch.
 - 4. Redundant suppression circuits.
 - 5. Redundant replaceable modules.
 - 6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 7. LED indicator lights for power and protection status.
 - 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 - 10. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 120 kA per phase.
- D. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
 - 1. Line to Neutral: 400V for 208Y/120.
 - 2. Line to Ground: 400V for 208Y/120.
 - 3. Neutral to Ground: 400V for 208Y/120.
- E. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
 - 1. Line to Neutral: 400 V.
 - 2. Line to Ground: 400 V.
 - 3. Neutral to Ground: 400 V.

- F. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
 - 1. Line to Neutral: 400 V, 800 V from high leg.
 - 2. Line to Ground: 400 V.
 - 3. Neutral to Ground: 400 V.

2.4 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard, Motor Control Center, and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - 1. Provide multi-pole, 30A circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect panelboards, Motor Control Centers to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust equipment installation, including connections, and to assist in field testing. Furnish all test results.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Testing: Perform the following field tests and inspections and prepare test reports:
 - 1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Complete startup checks according to manufacturer's written instructions.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
- C. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 264313

SECTION 265100 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaries and accessories.
- B. Luminaire accessories.

1.2 REFERENCES

- A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
- B. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
- D. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
- E. NFPA 70 - National Electrical Code.
- F. NFPA 101 - Life Safety Code.

1.3 SUBMITTALS FOR REVIEW

- A. Section 013323 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

1.4 SUBMITTALS FOR INFORMATION

- A. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Submit manufacturer's operation and maintenance instructions for each product.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.

- B. Conform to requirements of NFPA 101.
- C. Products: Listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Furnish Products as listed in Lighting Fixture Schedule in the Specification Drawings. Refer to Section 012513 for substitutions and product options.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
- B. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- C. Install wall mounted luminaires, emergency lighting units at height as scheduled.
- D. Install accessories furnished with each luminary.
- F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminary.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install specified lamps in each emergency lighting unit, and luminary.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminary after installation and connection. Inspect for proper connection and operation.

3.3 CLEANING

- A. Section 017719 - Contract Closeout.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

END OF SECTION 265100

SECTION 310000 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work covered by this Section shall include all excavation, trenching and related work for the construction of the designated structures and pipelines, backfill and other incidental work.
- B. The Work covered by this Section consists of:
 - 1. making all necessary excavations for the construction of all Work;
 - 2. preparing subgrade for foundations, slabs, walks, and pavements;
 - 3. doing all pumping, fluming, and dewatering necessary to keep the trenches and other excavation free from water;
 - 4. providing for uninterrupted flow of existing drains and sewers, and the disposal of water from any sources during the progress of the Work;
 - 5. supporting and protecting all trench walls, structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the Work;
 - 6. removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary;
 - 7. removing after completion of the Work all sheeting and shoring or other soil support materials not necessary to support the sides of trenches;
 - 8. removing and disposing all surplus excavated material;
 - 9. doing all backfilling and grading, of compacting backfill to limits specified or ordered by the Engineer;
 - 10. restoring all property damaged as a result of the Work involved in this Contract.
- C. The Work includes transporting surplus excavated materials not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, and disposal of all types of surplus material on the site.
- D. The Work includes:
 - 1. constructing a structure of soil or granular material in layers to a predetermined elevation and cross section;
 - 2. supporting and protecting all structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the Work;
 - 3. placing all fill and performing rough grading;
 - 4. compacting fill to limits specified or ordered by the Engineer;
 - 5. restoring all property damaged as a result of the Work involved in this Contract.
- E. The Work includes low strength mortar backfill material intended for use in backfilling as shown on the Drawings.

1.2 RELATED DOCUMENTS AND SECTIONS

- A. Section 013319 – Field Testing Requirements
- B. Section 312319 – Dewatering
- C. Section 310150 – Excavation Support and Protection
- D. Section 015713 - Temporary Erosion Control
- E. Section 030000 - Concrete Work

1.3 DEFINITIONS

- A. Backfill: Soil or granular materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, not including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding: Layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported for use as fill or backfill.
- D. Excavation: Removal and disposal of material encountered above subgrade or foundation elevations.
 - 1. Additional Excavation: Excavation below subgrade or foundation elevations as directed by Engineer.
 - 2. Trench: Narrow linear excavation
 - 3. Unauthorized Excavation: Excavation below subgrade or foundation elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
 - 4. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface or subsurface conditions encountered, including rock, soil materials and obstructions.
- E. Embankment: A structure consisting of soil, granular material, shale, rock, or other approved material, constructed in layers to a predetermined elevation and cross-section.
- F. Granular materials: Natural aggregate, such as broken or crushed rock, gravel, or sand that can be readily incorporated into an 8-inch layer, and in which at least 65% by weight of the grains or particles are retained in a No. 200 sieve.
- G. Laboratory Dry Weight: The maximum laboratory dry weight shall be the weight provided by the laboratory when the sample is tested in accordance with ASTM D-698 Method A, C, or D.

- H. Optimum Moisture: The water content at which the maximum density is produced in a soil by a given compaction effort (ASTM D-698).
- I. Pavement Prism: Also referred to as the zone of influence. The area below a line drawn 45 degrees to the horizontal from the surface at the edge of pavement, sidewalk or curb.
- J. Pipe Embedment: The material placed in a trench surrounding a pipe or conduit consisting of the foundation, bedding, haunching, and initial backfill.
- K. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material one (1) cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- L. Shale: Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered shale: mudstone, claystone, siltstone and hard clay.
- M. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical reaction.
- N. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, pavement, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.
- P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Comply with all provisions of Section 013323, Shop Drawings and Submittals.
- B. Product Data: For the following:
 - 1. Source-locations of all materials shall be identified to the Engineer.
 - 2. Source quality laboratory test of all fill materials as required to show compliance with material specifications.
- C. Shop Drawings: Submit information for the following items:
 - 1. Sheeting and bracing.
 - 2. Dewatering system and standby equipment.
 - 3. Protection methods anticipated.
 - 4. Excavation procedures.

- D. Project Record Documents: Accurately record actual locations of subsurface construction.
- E. Material Certification

1.5 REFERENCES

- A. AASHTO M 43 Standard Specification for Size of Aggregate for Road and Bridge Construction
- B. ASTM C-150 Standard Specification for Portland Cement
- C. ASTM C-618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- D. ASTM D-698 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
- E. ASTM D-1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils
- F. ASTM D-2487 Standard Test Method for Classification of Soils for Engineering Purposes
- G. ASTM D-2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- H. ASTM D-4253 Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- I. ASTM D-4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- J. State of Ohio - Department of Transportation - Construction and Material Specifications, Item 304, Aggregate Base.
- K. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.16, Suitable Materials for Embankment Construction.
- L. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.02.A.2, Fine Aggregate for Portland Cement Concrete

1.7 PROJECT CONDITIONS

A. Existing Conditions

1. Existing ground elevations of the site are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy himself, however, by actual examination on the site of the Work, as to the existing elevations and contours, and the amount of work required.

B. Existing Utilities

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
2. Notify Engineer not less than two days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Engineer's written permission.
4. Contact utility-locator service for area where Project is located before excavating.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the site, store and protect under provisions of Section 016600, Product Handling and Protection.
- B. Comply with all provisions of Section 013543, Environmental Protection.

1.9 SEQUENCING AND SCHEDULING

- A. Refer to 013319 for testing laboratory service scheduling.

1.10 PROHIBITION OF EXPLOSIVES

- A. The use of explosives is not permitted.

1.11 FIELD MEASUREMENTS

- A. The Contract Drawings may indicate locations where certain utilities, structures or facilities might possibly interfere with the installation of new improvements. The Contractor shall dig such exploratory test pits as may be necessary to determine the exact location and elevation of the indicated subsurface structure and shall make acceptable provision for their protection, support and maintenance in operation. The Engineer shall be provided advance notification when and where excavation for test pits will take place. The Contractor shall provide the Engineer a record of field locations of all listed utilities, structures or facilities a minimum of five (5) days prior

to initiating construction of the project. Locations and elevations are to be provided by a Surveyor registered in the State of Ohio.

PART 2 - PRODUCTS

2.1 GRANULAR PIPE EMBEDMENT

- A. Crushed gravel or crushed limestone meeting AASHTO M 43 gradation shall be used for bedding, haunching, and initial backfill as shown on the Drawings.

2.2 ONSITE BACKFILL

- A. Excavated soil material, capable of meeting specified compaction, and approved by the Engineer for use as backfill in designated locations.
- B. Based upon subsurface investigation, the Owner does not guarantee the onsite soils in its present state consists of the proper moisture content to achieve the specified compaction without drying or adding water.
- C. Unsuitable Backfill Material
 - 1. Onsite materials that are unsuitable for backfill, unless otherwise specifically shown in the Drawings, include rock or other materials greater than six (6) inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, frozen earth, and the following soils classified per ASTM D-2487:

Symbol	Description
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

2.3 SPECIAL BACKFILL MATERIAL (ODOT Item 304)

- A. Special backfill material shall meet the gradation requirements of ODOT Item 304 and shall consist of crushed gravel or crushed limestone in combination with natural sand or stone. The aggregate shall meet the following gradation requirements:

Sieve	Total Percent Passing
2 inch	100
1 inch	70-100
¾ inch	50-90
No. 4	30-60
No. 30	9-33
No. 200	0-15

2.4 LOW STRENGTH MORTAR BACKFILL

- A. Low Strength Mortar shall comply with ODOT Item 613.
- B. Submit test data that demonstrates that the proposed mix has a strength of 50 to 100 PSI at 28 days.
- C. Each load shall be tested with 3 cylinders for strength test broken at 3, 7, and 28 days until the Engineer is assured that the mix will be between 50 to 100 PSI at 28 days. Thereafter, one set of strength tests shall be taken every 50 CY.

It is intended that the sand be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.

- D. Mortar Mix Proportioning
 - 1. The initial trial mixture shall be as follows:

Quantity of Dry Materials per Cubic Yard

Cement	100 lbs.
Fly Ash	250 lbs.
Sand (SSD)*	2700 lbs.
Water	500 lbs.

* saturated-surface dry

- 2. These quantities of materials are expected to yield approximately 1 cubic yard of mortar of the proper consistency. Adjustments of the proportions may be made providing the total absolute volume of the materials is maintained.

2.5 EMBANKMENTS

- A. Soils suitable for use in an embankment must conform to ODOT 703.16 and are restricted as follows:
 - 1. Maximum laboratory dry weight shall not be less than 90 pounds per cubic foot, except that soils having maximum dry weights of less than 100 pounds per cubic foot shall not be used in the top 12 inches of embankment.
 - 2. Soil having a liquid limit in excess of 49 are considered as unsuitable for use in an embankment.
 - 3. Silt from excavation or borrow identified as Ohio Classification A-4b shall be considered suitable for use in an embankment only when placed at least 3 feet below the surface of the subgrade.
 - 4. No slag, recycled Portland cement concrete or recycled asphaltic concrete products are suitable for use in an embankment.
 - 5. Do not use any suitable material that cannot be incorporated in an 8-inch lift in the top 2 feet of the embankment.
 - 6. Do not use shale, hard shale, or siltstone in the top 2 feet of embankment.
 - 7. Do not use materials that cannot be satisfactorily placed and compacted to a stable and durable condition.

8. Material excavated in the work that contains excessive moisture is unsuitable for embankment construction unless dried. Dry or aerate such material before incorporating in the work. The Contractor may elect to waste this material, instead of drying it.
9. Granular material Type E as specified in ODOT 703.16.C, is not allowed.
10. No petroleum contaminated soils are suitable for use in an embankment.

2.6 ENGINEERED FILL

- A. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940. The aggregate shall meet the following gradation requirements:

<u>Sieve</u>	<u>Total Percent Passing</u>
2 inch	100
1½ inch	95-100
¾ inch	70-92
3/8 inch	50-70
No. 4	35-55
No. 30	12-25
No. 200	0-8

PART 3 - EXECUTION

3.1 PROTECTION

- A. Excavation; Temporary Sheet piling, Shoring, and Bracing
 1. All excavation shall be in accordance with the Occupation Safety and Health Administration (OSHA) regulations.
 2. The Contractor shall furnish and install adequate sheet piling, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent neighboring structures from damage by settlement.
 3. Bracing shall be arranged so as not to place a strain on portions of completed work until construction has proceeded enough to provide ample strength. Sheet piling and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.
4. All sheet piling shall be removed unless specifically authorized in writing by the Engineer to be left in place.
- B. Construction Sheet piling Left in Place
 1. Any construction sheet piling and bracing which the Contractor has placed to facilitate his work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheet piling and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheet piling and bracing left in place shall not relieve the Contractor of his responsibility under this Contract.

3.2 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

- A. The Contractor shall:
 - 1. replace, move, repair and maintain all utilities and all other structures encountered in the work
 - 2. coordinate and communicate with applicable utility companies
 - 3. repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of this contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the satisfaction of the Engineer.

3.3 DEWATERING

- A. Drainage and Removal of Water
 - 1. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures.
 - 2. The Contractor shall, when ordered by the Engineer, construct tight bulkheads across trench and provide pumps suitable for the removal of any water which may be encountered or which may accumulate in the trenches. Unless otherwise provided for in the Contract Documents, drainage water will not be permitted to flow through the conduit.
 - 3. The trench shall be kept free from sewage and storm, surface, and subsurface water to at least 2 feet below the bottom of the excavation.
 - 4. Where open water courses, ditches, or drain pipes are encountered during the progress of the Work, the Contractor shall provide protection and securing of the continuous flow in such courses or drains and shall repair any damage that may be done to them.

3.4 EXCAVATION CLASSIFICATION

- A. All excavated materials are unclassified as defined in Article 1.3.

3.5 GENERAL EXCAVATION

- A. All necessary excavation for buildings, structures, pavements, and site improvements shall be performed to accommodate the completion of all related Contract Work.
- B. The Drawings show the horizontal and the lower limits of structures. The methods and equipment used by the Contractor when approaching the bottom limits of excavation shall be selected to provide a smooth surface and to prevent disturbing the soil below the bottom limits of excavation. All soil loosened during excavation shall be removed from the bottom of the excavation.
- C. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

- D. Excavation which is carried below the bottom limits of structures shall be classified as Unauthorized Excavation, unless said excavation below bottom limits of structures has been authorized by the Engineer prior to each occurrence.
- E. Unauthorized Excavation shall be filled with Class B concrete to the bottom limits of structures. Under circumstances where structural integrity is not a factor, the Engineer may authorize the filling of Unauthorized Excavation with Low Strength Mortar Backfill or Special Backfill material compacted to 100% density as specified under the compaction requirements in this Section. Such work shall be at the cost of the Contractor.

3.6 TRENCH EXCAVATION

- A. Excavation for trenches in which pipelines, sewers, and conduits are to be installed shall provide adequate space for workmen to space and joint pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench shall not exceed the limits shown on the Drawings.
- B. Excavation shall be to the depth necessary for placing of granular bedding material under the pipe as shown on the Drawings. If over-excavation occurs, the trench bottom shall be filled to grade with compacted granular bedding material.
- C. Trenching operations shall not be performed beyond the distance that will be backfilled and compacted the same day.
- D. In general, backfilling shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

3.7 EXCAVATION OF UNSUITABLE MATERIALS

- A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as directed by the Engineer. Such excavation shall not exceed the vertical and lateral limits as prescribed by the Engineer.
- B. In utility trenches, the voids left by removal of unsuitable excavated material shall be filled with AASHTO M 43 No. 1 and No. 2 aggregate conforming to the material requirements of Article 2.1 of this Section.
- C. In excavations other than utility trenches, the voids left by removal of unsuitable excavated material shall be filled with material consisting of either: (1) Special Backfill Material; (2) Class B concrete; or (3) Low Strength Mortar Backfill, whichever is ordered by the Engineer.
- D. Removal of unsuitable excavated material and its replacement as directed will be paid on basis of Contract Conditions relative to Changes in Work unless specific unit prices have been established for excavation of unsuitable material.

3.8 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. It shall be the responsibility of the Contractor to dispose of all surplus material that cannot be used in backfill or embankments at his expense outside the limits of the project. Unsuitable excavated material, including rock or large boulders, shall be disposed of on the existing treatment plant property.
- B. Surplus material will be stockpiled in the area adjacent to the existing sludge dewatering building.

3.9 BACKFILL

- A. Pipelines, Sewers and Conduits
 1. All pipe shall have bedding extending the width of the trench with depth in conformance with the Drawings. The bedding material shall be thoroughly compacted by tamping until no further densification is possible.
 2. Pipe cover material shall be used for filling above the pipe bedding along the sides of the pipe and to a height of twelve (12) inches over the top of the pipe. The pipe cover material shall be brought up evenly on both sides of the pipe to eliminate the possibility of lateral displacement of the pipe and shall be thoroughly compacted by tamping until no further densification is possible. Care shall be taken to spade the aggregate under the pipe haunch below the spring line.
 3. All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer.
 4. After the pipe cover has been placed and compacted around the pipe as specified above, the remainder of the trench may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a pipe and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.
- B. Structures
 1. Backfilling shall not commence before concrete has attained specified strength. Do not use equipment for backfilling and compaction operations against structures that will overload the structure.
 2. Backfilling around and over structures shall be carefully placed and tamped with tools of suitable weight to a point one (1) foot above the top of same. Additional backfill may be required to protect the structure from damage from heavy equipment. Backfill shall be placed in uniform layers not exceeding eight (8) inches in depth. Each layer shall be placed, then carefully and uniformly compacted to the specified density so as to eliminate the possibility of displacement of the structure.
 3. After the backfill has been placed and compacted around the structure to the height specified above, the remainder may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved

methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a structure, and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

- C. Where any new, proposed, or future pavement, driveway, parking lot, curb, curb and gutter, or walk is to be placed over a backfilled area, Special Backfill material shall be used for any portion of the trench falling within the pavement prism.
- D. Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with approved Granular Pipe Embedment Material compacted in place in eight (8) inch layers to the required density. The approved Granular Pipe Embedment Material shall extend outward from the spring line of the conduit a distance of two (2) feet on either side and thence downward at its natural slope.

3.10 LOW STRENGTH MORTAR BACKFILL

- A. Low strength mortar backfill shall be discharged from the mixer as recommended by the supplier and approved by the Engineer.
- B. Low strength mortar backfill may be placed in the trench in as few lifts as may be practical.
- C. Secure conduit or pipelines before placing low strength mortar backfill to prevent conduits and pipelines from floating during backfilling.
- D. For low strength mortar backfill placed against existing structures of unknown strength, backfill material shall be brought up uniformly in maximum 12 inch lifts and allowed to cure for a minimum of 24 hours or until it can carry a person's weight without leaving imprints before the next lift is placed.
- E. Low strength mortar backfill shall be brought up to subgrade elevation or the pavement prism, whichever may be applicable.

3.11 EMBANKMENT

- A. In making fill for embankment, the surface of the existing ground shall be cleared, grubbed, stripped of organic material, plowed, compacted according to the requirements specified in this Section, and stepped on slopes so as to enable bond or firm bearing for the new fill. The materials for these fills shall be selected of approved materials free from organic matter and placed in horizontal layers not exceeding eight (8) inches in thickness when loose, each layer being thoroughly compacted. Materials shall not be placed when fill or foundation is frozen.
- B. Where fill is to be placed on side slopes steeper than one (1) vertical to six (6) horizontal, steps shall be formed into the slope before any embankment is placed. These steps shall be cut at vertical intervals at no more than two (2) feet and shall have a horizontal dimension of not less than three (3) feet.

- C. As fill progress, the top shall be kept crowned or sloped for drainage. No pavement shall be placed upon embankment until it meets compaction testing requirements.
- D. Fills that abut or contain concrete or masonry structures shall be placed with care to avoid undue or unbalanced loads on these structures.
- E. Following the completion of embankment, all slopes shall be neatly and evenly dressed to proper elevation, grade and dimension.

3.12 SUBGRADE

- A. All soil subgrade shall be prepared in accordance with this subsection.
- B. Drainage
 - 1. The surface of the subgrade shall be maintained in a smooth condition to prevent ponding of water after rains to insure the thorough drainage of the subgrade surface at all times.
- C. Unsuitable Subgrade
 - 1. Where unsuitable subgrade or subgrade not meeting the required bearing capacity is encountered in cuts, due to no fault or neglect of the Contractor, in which satisfactory stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.
 - 2. Suitable material required for the embankment to replace the undercut will be paid on basis of Contract Conditions relative to changes in Work.
 - 3. Where soft subgrade in cuts is due to the failure of the Contractor to maintain adequate surface drainage as required in this article, or is due to any other fault or neglect of the Contractor, the unstable condition shall be corrected as outlined above at no expense to the Owner.

3.13 CONSTRUCTION WITH MOISTURE AND DENSITY CONTROL

- A. All backfill and embankments, except rock embankments, shall be constructed using moisture and density control. All subgrade, except rock and shale in cut sections, shall be constructed using moisture and density control.
- B. Backfill, embankment and subgrade material which does not contain sufficient moisture to be compacted in accordance with the requirements of Article 3.17 of this Section shall be sprinkled with water as directed by the Engineer to bring the moisture content to within the range of optimum plus or minus three (3) percent. Water shall be thoroughly incorporated into the material by means of discs or other approved equipment.
- C. Backfill, embankment and subgrade material containing excess moisture shall be dried, prior to installation, to a moisture content not greater than three (3) percentage points above optimum, except that for material within the moisture content range specified herein that displays pronounced elasticity or deformation under the action of loaded construction equipment, the moisture content shall be reduced to optimum or

below if necessary to secure stability. For subgrade material, these requirements for maximum moisture shall apply at the time of compaction of the subgrade and also at the time of placing pavement or subbase. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the Engineer.

3.14 PROOF ROLLING

- A. Proof rolling shall be performed on all stoned areas across the site
- B. Proof rolling equipment shall consist of a single unit, tandem axle dump truck capable of being loaded to 30,000 pound axle load with a gross vehicle weight of 60,000 pounds. Tire pressure shall be maintained at 90 psi. Loading shall be verified by a certified weight slip.
- C. Procedure
 - 1. The designated areas of subgrade, prior to the placing of the overlying course, shall be compacted to requirement of this Section. The Contractor shall be responsible for performing a minimum of two (2) proof rolling's; one (1) of the sub-grade and one (1) of the finished stone surface.
 - 2. Moisture content of the subgrade at the time of proof rolling shall conform to the requirements of this Section.
 - 3. The equipment shall be operated at the speed directed, but in no case shall the speed exceed five (5) miles per hour, and the normal operating speed shall not be less than two (2) miles per hour.
 - 4. Where the operation of the proof roller shows the subgrade to be unstable or to have non-uniform stability, the Contractor shall correct the unstable areas so that the stability of the subgrade will be uniform and satisfactory. The subgrade shall then be checked for conformance to the plan lines and any irregularities of the surface caused by operation of the proof roller shall be corrected and the subgrade shall be shaped to the plan lines within the tolerances specified in this Section.
 - 5. The proof roll is a subjective test and does not relieve the Contractor of his responsibility under the Contract to provide an acceptable subgrade.
 - 6. If the subgrade fails due to the Contractor using it as a haul road or due to his negligence, the subgrade shall be repaired, retested, and proof rolled again at no additional cost to the Owner.

3.15 COMPACTION REQUIREMENTS

- A. The bottom of excavations upon which concrete foundations or structures are to be placed shall be compacted so as to obtain 100% of maximum dry density per ASTM D-698 in the top twelve (12) inches.
- B. The top twelve (12) inches of stripped original subgrade and final subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
 - 1. Subgrade under new, proposed, or future pavement shall be compacted 18 inches beyond the edge of pavement, paved shoulders or paved medians.

- C. Compaction of subgrade for sidewalks (regardless of paving material) shall be 100% of maximum dry density per ASTM D-698 in the top six (6) inches.
- D. Compaction of non-paved areas shall be 90% of maximum dry density per ASTM D-698.
- E. Aggregate pipe embedment and aggregate backfill around structures shall be compacted to not less than 100% of maximum dry density per ASTM D-4253 and ASTM D-4254.
- F. Final backfill shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
- G. Fill placed within the interior of structures shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
- H. Embankment shall be placed and compacted in layers until the density is not less than the percentage of maximum dry density indicated in the following table determined by ASTM D-698.

EMBANKMENT SOIL COMPACTION REQUIREMENTS

Maximum Laboratory Dry Weight <u>Pounds/Cubic Foot</u>	Minimum Compaction Requirements Percent Laboratory <u>Maximum</u>
90-104.9	102
105-119.9	100
120 and more	98

- I. Test Sections
 - 1. If it is determined by the Engineer that the composition of the material is such that it cannot be tested for density using a nuclear densometer or other methods; or where, in the opinion of the Engineer, in-place compaction testing is not feasible; and if approved by the Engineer, the Contractor may construct a test section to demonstrate acceptable compactive effort in lieu of in-place compaction testing. Test sections shall be constructed at no additional cost to the Owner.
 - 2. The test section shall be completed by repeatedly compacting the material until no further density is achieved. This value shall be the Minimum Test Section Density (MTSD). The compaction equipment used to complete the test section shall be of suitable size to compact the material and shall be the same equipment used to compact the in-place material.
 - 3. The test section shall be constructed with moisture density control as specified in this Section.
 - 4. The material shall be compacted to at least 98% of the MTSD.

5. Each lift of in-place fill or backfill shall be densified using a compactive effort equal to or greater than the effort applied to achieve the MTSD; i.e., if six passes were required to achieve MTSD, then each lift of material shall be compacted using six or more passes.
6. Construct a new test section when, in the opinion of the Engineer, the fill or backfill material has changed character or when the supporting material has changed character.

3.16 GRADING

- A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading
 1. Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - a. Lawn or unpaved areas shall be graded to plus or minus 1 inch.
 - b. Walks shall be graded to plus or minus 1 inch
- C. Grading inside Building Lines
 1. Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION 310000

SECTION 310150 - EXCAVATION SUPPORT AND PROTECTION

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 temporary excavation support and protection systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

- A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.
 - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For Installer and professional engineer.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
 - 2. The geotechnical report is included elsewhere in the Project Manual.
- C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 4 inches.
- E. Shotcrete: Comply with Division 3 Section "Shotcrete" for shotcrete materials and mixes, reinforcing, and shotcrete application.
- F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

- A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at centers indicated and secure to soldier beams.

3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

- A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.

2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
 2. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 310150

SECTION 312216.13 - SCARIFYING, PULVERIZING, SHAPING AND COMPACTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. This work shall consist of scarifying, crushing, pulverizing, adding new material, as required, shaping to the plan grade, rolling, and compacting the aggregate to the proper elevation and slope.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

- A. Rollers shall be of the types specified in ODOT Specifications 401.11 for pneumatic tire rollers and vibratory rollers.
- B. Crushing equipment shall be a rotary reduction machine capable of pulverizing in place pavement material 14" or less in thickness to a 2" minus size. The rate of forward speed must be positively controlled insuring uniformity in maximum size of the reduced material.

PART 3 - EXECUTION

3.1 SCARIFYING AND PULVERIZING

- A. Using the pulverizer, the material shall be scarified and uniformly pulverized to a maximum size of 2 inches and to a depth of 6 inches.

3.2 GRADING

- A. Excess existing material shall be removed to the depth and slope specified on the plans or in the proposal. The material shall be disposed of by the Contractor.

3.3 SHAPING

- A. Prior to compaction, the mixture shall be shaped as necessary for compliance after compaction with the typical sections and the surface tolerances of ODOT 304.04.

3.4 COMPACTION

- A. Compaction shall follow mixing as closely as conditions permit. Should the mixture be unstable under the rollers due to excess moisture, the Engineer may require the mixture to be aerated using the in-place mixer to reduce the moisture content. Compaction requirements shall be as provided in ODOT 304.04 except that water shall not be applied.

3.5 DUST CONTROL

- A. The Contractor shall be responsible for controlling dust throughout the project.

3.6 METHOD OF MEASUREMENT

- A. The number of square yards of stabilization shall be calculated using plan lines and dimensions.

END OF SECTION 312216.13

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, equipment, and incidentals to lower the water table, to collect and pump water from excavations, to collect and divert surface drainage from entering the excavation during construction and to dispose of pumped water to the existing or new storm conveyances.
- B. This section specifies designing, furnishing, installing, maintaining, operating, and removing temporary dewatering systems required to lower and control ground water levels, hydrostatic pressures, and control surface water, and precipitation entering the excavation during construction; disposing of pumped water; constructing, coordinating, maintaining and observing, installing and removing of equipment and instrumentation for the control of the system.
- C. Dewatering includes lowering the water table, intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation, collecting and pumping water seepage that enters the excavations; increasing the stability of excavated slopes; preventing loss of material from the slopes or bottom of the excavation; improving the excavating and hauling characteristics of on-site soil; preventing rupture or heaving of the bottom of an excavation and disposing of pumped water.

1.2 REFERENCES

- A. The specifications in this section are subject to the administrative and procedural requirements specified in Division 1, as well as the requirements of the General Conditions.

1.3 SYSTEM DESCRIPTION

- A. The Contractor is responsible for the adequacy of the design of the dewatering system to:
 - 1. Pre-drain the water-bearing strata above and below the bottom of the structure foundations, drains, sewers and all excavations.
 - 2. Effectively reduce and maintain the hydrostatic pressure and lower the groundwater levels in the water-bearing strata below the structure foundation, drains, sewers, and all excavations. The ground water level shall be maintained at all times a minimum of 18 inches vertically below the bottom of the structure foundations and the pipelines.

3. Prevent structures, utilities, sidewalks, pavements, and other facilities, at the work location and areas adjacent to the work location which may be affected by the dewatering operations from any settlement, subsidence, lateral movement, undermining, washout, and other hazards created by dewatering operations as may be determined by the Owner's Representative. The Owner's Representative will take elevations of existing building corners periodically. If the aforementioned conditions develop as determined by the Owner's Representative, the Contractor shall remedy the situation to the satisfaction of the Owner's Representative at no additional expense to the Owner.
 4. Prevent quick conditions, seepage, boils, the loss of fines, or the softening of the foundation strata.
 5. Maintain the stability of the sides and bottoms of the excavations.
 6. Result in all construction operations being performed in the dry.
 7. Provide ramp or road crossings for access to and around the excavation.
 8. Provide a system, including standby generator(s) to maintain dewatered conditions during any maintenance or electrical outage that might occur during the dewatering activities.
 9. Discharge in accordance with OEPA Construction Storm Water Regulations.
 10. Discharge water from the system in a closed conduit or water channel of adequate capacity to handle said discharge that will safely convey the discharge to the local watershed.
 11. Provide adequate protection against erosion of materials at the entrance to and exit from the closed conduit or water channels.
 12. Provide separate circuits to power the dewatering system such that the failure of any one of those circuits does not impede the efficiency of the entire system.
 13. Provide an isolation/shutoff valve and a check valve in each well discharge line when used.
 14. Provide that all pumps and motors used for the dewatering system shall be properly sized, tested, and suitable for their intended use.
 15. Provide a means to measure total daily pumpage from the dewatering system. This information shall be submitted to the Owner's Representative on a daily basis in the form of a daily report.
 16. All dewatering wells (when used) shall be developed until the total suspended solids is less than three (3) parts per million and the discharge shall be maintained at or below this level.
- B. Locate dewatering facilities where they would not interfere with utilities, demolition and construction work.
- C. Modify dewatering procedures, which may threaten to cause damage to existing facilities so as to prevent damage. Such modifications shall be made at no additional expense to the Owner.

1.4 SUBMITTALS

- A. Shop Drawings: The Contractor shall provide dewatering plan including drawings and written text which illustrates the location and identification of the components of the proposed dewatering system. The plan shall include but is not limited to the following:

1. Proposed locations and number of wells, well points and monitoring wells.
2. Proposed casing diameters and depths.
3. Proposed location and size of the discharge piping.
4. Proposed estimated total pumping horsepower and standby power generator(s) capacity.
5. Proposed procedure in an emergency event.

B. Other: Agency permits, if required, for discharge.

1.5 QUALITY ASSURANCE

- A. Permits, if required by local, state or federal agencies for the dewatering system to discharge into the receiving stream or waters, as applicable shall be obtained by the Contractor prior to commencement of dewatering. Submit copies of permits to the Owner's Representative.
- B. All wells installed by the Contractor shall be logged and all logs submitted to the Ohio Department of Natural Resources, (ODNR) Division of Water on the appropriate form in accordance with ODNR requirements. Copies of logs shall be submitted to the Owner's Representative.
- C. The Contractor shall be required to complete submittals required by ODNR ground water withdrawal facility registration. Submittals shall be made directly to ODNR and copies to the Owner's Representative.
- D. The Contractor shall be required to complete submittals required by ODNR well abandonment procedure consistent with Part. 3.01 of this Section. Submittals shall be made directly to ODNR and copies to the Owner's Representative.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of the dewatering system shall not interfere with daily activities of the plant.
- B. The Contractor shall keep the Owner's Representative advised of any changes made to accommodate field conditions and, on completion of the dewatering system installation, revise and resubmit information drawings as necessary to show the installed configuration.
- C. The Contractor shall organize dewatering operations to lower the ground water level in excavations or remove water from excavations as required for completion of the work and to provide a stable, dry subgrade for the completion of subsequent work. Take all precautions to prevent disturbances of foundations soils.

- D. In the event that any part of the dewatering system may become inadequate or fail, the Contractor shall provide complete standby equipment including a power generator(s) installed and available and additional pumps. The standby equipment will be for immediate use as may be required to adequately maintain the dewatered conditions at all times.
- E. The dewatering system shall operate twenty-four (24) hours per day; seven (7) days per week during duration of dewatering and a responsible person will be on-call for the duration of dewatering operations to respond to emergencies and any events that arise.
- F. The Contractor shall be responsible for providing all electrical controls and power distribution. All conductors shall be copper and all enclosures shall be minimum NEMA 3R. Costs for maintenance of electrical components associated with the dewatering system shall be the responsibility of the Contractor. The Contractor shall meter and pay all costs for power associated with dewatering and installation of the system.
- G. In general, the power distribution to the dewatering system shall follow closely the route of the dewatering system piping. These conductors shall be encased in a conduit system that shall be either PVC - Schedule 80, Aluminum (heavy wall), or rigid galvanized conduit.
- H. The Contractor shall obtain the Owner's Representative's written approval before shutting down the dewatering system for any reason. The Contractor shall obtain written approval from the Owner's Representative before discontinuing the operation of any part of the dewatering system.

3.2 ABANDONMENT

- A. Abandonment of wells shall be by the Contractor with no additional cost to the Owner.
- B. Upon completion of dewatering and contingent upon the approval the Owner's Representative, the Contractor shall remove and properly seal all monitoring and dewatering wells installed by the Contractor in accordance with ODNR well abandonment procedures.
- C. The Contractor shall also submit copies of "Water Well Sealing Report" to ODNR and the Owner's Representative for each well that is abandoned.

END OF SECTION 312319

SECTION 312323.13 - COMPACTED BACKFILL

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 WORK

- A. The Contractor shall furnish, place and compact all the materials needed from select excavated materials or furnish additional suitable material if the excavated material is deemed unsuitable or the moisture content is not or cannot be made to be within acceptable tolerances of optimum moisture to achieve the specified compaction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Suitable excavated material as specified in ODOT Item 203.

PART 3 - EXECUTION

3.1 PLACING

- A. Compacted backfill shall be properly placed in layers sufficient to meet the compaction requirement of 95% of maximum laboratory dry density per ASTM D 698 throughout the entire layer and thoroughly compacted with mechanical compaction equipment with moisture adjustment as needed. Should after settlement occur, the Contractor must add and compact additional material, and he must maintain the backfill at the required finished grade or sub-grade until the project is satisfactorily completed and during the correction period.
- B. Approved mechanical compaction equipment shall be used for tamping backfill. Flooding, jetting or puddling of backfill will not be permitted.

END OF SECTION 312323.13

SECTION 312323.14 - COMPACTED GRANULAR BACKFILL

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 WORK

- A. The Contractor shall furnish, place and compact all the materials needed.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Trench backfill shall be limestone aggregate well graded from coarse to fine and be free of dirt and shall be of an aggregate size conforming to ODOT No. 304 and material type shall be as per ODOT No. 304 except that slag and recycled concrete products are unacceptable as compacted granular backfill material.
- B. Drainage fill shall be a washed, evenly graded mixture of crushed limestone conforming to a modified aggregate size No. 57, 67 or 467 with 100% passing a 1-1/2 inch sieve and not more than 5% passing a No. 4 sieve. Slag and recycled concrete products are unacceptable as drainage fill material.
- C. Contractor shall submit current test reports for the lot(s) of the material to be supplied.

PART 3 - EXECUTION

3.1 PLACING AND COMPACTING

- A. Compacted granular backfill shall be properly placed in layers sufficient to meet the compaction requirement of 100% of maximum laboratory dry density per ASTM D 698 throughout the entire layer and thoroughly compacted with mechanical compaction equipment with moisture adjustment as needed. Should after settlement occur, the Contractor must add and compact additional material, and he must maintain the backfill at the required finished grade or sub-grade until the project is satisfactorily completed and during the correction period.

- B. Approved mechanical compaction equipment shall be used for tamping backfill. Flooding, jetting or puddling of backfill will not be permitted.

END OF SECTION 312323.14

SECTION 312323.33 - LOW STRENGTH MORTAR BACKFILL MATERIAL

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 WORK

- A. This work shall consist of the placement of a flowable low strength mortar for backfilling conduits or at other locations as shown on the plans or as specified. The work shall be in accordance with ODOT Item 603 and 499 unless otherwise specified.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement

- 1. ODOT 701.01 or ODOT 701.04.

- B. Fly Ash

- 1. Fly Ash shall come from a source approved by the Engineer.

- C. Fine Aggregate

1. Fine Aggregate shall be natural sand consisting of mineral aggregate particles. The gradation of the sand shall be as follows:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/4"	100
200	0 - 10

2. It is intended that the sand be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.

2.2 MORTAR MIX PROPORTIONING

- A. The initial trial mixture shall be as follows:

Quantity of Dry Materials per Cubic Yard

Cement	100 lbs.
Fly Ash	250 lbs.
Sand (SSD)*	2700 lbs.
Water	500 lbs.

* saturated-surface dry

- B. These quantities of materials are expected to yield approximately 1 cubic yard of mortar of the proper consistency. Adjustments of the proportions may be made providing the total absolute volume of the materials is maintained.

PART 3 - EXECUTION

3.1 TRIAL BATCH

- A. To expedite consolidation of the mortar, it will be necessary for bleed water to appear on the surface immediately after the mortar is struck off.

A delay in bleeding indicates there are too many fines in the mixture, so the fly ash quantity shall be reduced in increments of 50 lbs. until mixture is bleeding freely. Approximately 60 lbs. of sand shall be added to replace each 50 lbs. of fly ash to maintain the original yield.

- B. Fluidity of the mortar mixture shall be measured by the Corps. of Engineers' Flow Cone Method according to CRD-C611. Prior to filling the flow cone with mortar, the mixture shall be passed through a 1/4-inch screen. Time of efflux shall be approximately 12 seconds.
- C. Prior to the first placement, the Contractor shall make one or more trial batches of mortar of the size to be hauled to job site and shall cast one or more test samples equivalent to the approximate dimensions of the trench to be backfilled (either in a form or trench). Amount of bleeding, settlement rate and time required to support pavement replacement shall be determined from these full-size tests. The Contractor shall furnish the required materials and samples.

3.2 MIXING EQUIPMENT

- A. Sufficient mixing capacity of mixers shall be provided to permit the mortar to be placed without interruption.

3.3 PLACING MORTAR

- A. Flowable mortar shall be discharged from the mixer by any reasonable means into the space to be filled. The fill material shall be brought up uniformly to the fill line shown on the plans or as directed by the Engineer.

END OF SECTION 312323.33

SECTION 312323.53 - FOUNDATION CUSHION

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place, at all locations where called for by the drawings or when deemed necessary by the Engineer, a cushion of well compacted crushed limestone or slag and screenings.
 - 1. The purpose of the foundation cushion is to provide a stable surface to perform the work on the project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The slag and screenings shall be obtained from freshly panned slag graded in three (3) sizes up to two and one-half (2-1/2) inches and shall be free from all deleterious material. Crushed limestone shall be similarly graded and shall be thoroughly washed.

PART 3 - EXECUTION

3.1 PLACING

- A. The crushed limestone or slag and screenings shall be placed in layers not over six (6) inches in depth and thoroughly compacted into the material below. The larger size shall be placed first, and this shall be followed by the intermediate size and, lastly, by the screenings. The amount of material of each size to be placed will depend upon the nature of the ground to be compacted. The placing of this material shall be continued until the required depth is placed, and the top of the cushion shall be finished to the lines and grades given by the Engineer.

END OF SECTION 312323.53

SECTION 312333 - UNDERGROUND CONDUIT INSTALLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Construction Drawings and General Provisions of this Contract including the General and Supplementary Conditions, Specific Project Requirements, Proposal, and all referenced standard specifications apply to work defined in this section.

1.2 DESCRIPTION

- A. This work shall consist of the construction or reconstruction of underground pipe conduits in accordance with these specifications and in reasonable close conformance to the lines and grades shown on the detailed plans or as otherwise established by the Engineer.
- B. This work shall include excavating for the conduit, fittings, and appurtenances; clearing and grubbing and removal of all materials necessary for placement of the conduit except any items paid for separately; furnishing and placing bedding and backfill as required; constructing and subsequently removing all necessary cofferdams, cribs and sheeting; pumping and dewatering; making all conduit joints as required; installing all necessary conduit; joining to existing and proposed appurtenances as required; performing leakage tests as required; restoration of all disturbed facilities and surfaces. The work shall also include the maintenance of existing flow and service to facilities being modified. Procedures for such maintenance shall be as approved by the Engineer prior to any work commencing.

PART 2 - MATERIALS

2.1 CONDUIT

- A. All conduit utilized shall be of one type and size specified in the proposal meeting the requirements of the detailed material specification.
- B. Shop drawings, catalog cuts, and test certifications may be required by the Engineer for all conduit, fittings, and appurtenances.
- C. Aggregate for the bedding and backfill shall conform to the requirements of the plan detail or as modified in writing by the Engineer. All aggregates shall conform to ODOT 703 for soundness and gradation.

- D. All other materials utilized as part of this work shall meet their respective ASTM requirements.

PART 3 - EXECUTION

3.1 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

A. Pavement, Sidewalks, and Curbing

1. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat, and free from chipped or damaged edges.
2. For non-reinforced concrete, the saw cut shall be completely through concrete.
3. For reinforced concrete, the saw cut shall be completely through the steel and concrete.
4. If the concrete is coated with a bituminous surface or other material, the saw cut shall be as specified above.

B. Manholes, Catch Basins, and Inlets

1. Existing drainage structures and sanitary manholes designated by the Engineer to be removed shall be completely removed.
2. Manholes designated to be abandoned shall be removed to an elevation of at least 3 ft. below the finished subgrade or ground surface. The remaining void shall be filled with backfill material in accordance with Section 312323.13 - Compacted Backfill.
3. Live sewers connected to structures removed or abandoned shall be rebuilt through the area with new conduit. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.
4. All castings salvaged from abandoned or removed structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a nearby site designated by the Owner or incorporated in the work where called for on the drawings.

C. Guardrail and Fence

1. Where necessary, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.
2. Posts and other materials not considered salvageable by the Engineer shall be disposed of by the Contractor.
3. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

3.2 METHOD OF EXCAVATION

- A. All excavation shall be in open cut unless otherwise permitted by the Engineer. Loosening of material by blasting will not be permitted without written authorization by the Owner specifying both the extent and location of the blasting to be done. If permission is granted the Contractor shall submit in writing his means and methods of blasting to the Owner for approval. Blasting shall not begin until the Owner issues written approval of the means and method of blasting.
- B. Excavation shall be made to undisturbed finish subgrade to the depth below the bottom of the conduit or structure as shown on the Contract Drawings details.
- C. Trenches shall be excavated with vertical sides from the bottom of the trench to one (1') foot above the top of the conduit from which point sides may slope to ground surface, except that, in streets or roadways, trenches shall be excavated with near vertical sides to the top of the trench. Width of trench in the vertical section shall be excavated only as wide as necessary to accommodate a safety box and to provide free working space on each side of the conduit or structure according to the size of the conduit or structure and the character of the ground. In every case there shall be sufficient space between the conduit or structure and the sides of the trench to make it possible to thoroughly ram the bedding around the conduit or structure and to secure tight conduit joints, but in no case more than twelve inches on either side of conduit. In no case, however, shall the width of the trench at the top of the conduit exceed the dimensions as shown on the contract drawings. In no case will it be permitted to excavate conduit trenches with sides sloping to the bottom.
- D. The trench bottom shall be firm and uniform for its full length. Should unstable material be encountered below plan subgrade, it shall be removed to a depth directed by the Engineer. Replacement of the additional excavation shall be with the specified bedding material or as otherwise directed by the Engineer.
- E. In the case the flow line is changed not to exceed one (1) foot or it becomes necessary to remove unstable material in an amount not to exceed one (1) foot, the same shall be done at one contract bid price or amount. When the flow line is lowered more than (1 foot) or if it becomes necessary to remove more than (1 foot) of unsuitable material below the

bottom of the trench, compensation will be provide therefore in a supplemental agreement for the excavation and backfill beyond (1 foot).

3.3 UNAUTHORIZED EXCAVATIONS

- A. All excavations carried outside of the lines and grades given or specified, together with the disposal of such material, and all excavations and other work resulting from slides, cave-ins, swellings or upheavals shall be at the Contractor's own cost and expense. All spaces resulting from unauthorized excavations or from slides or cave-ins shall be refilled at the Contractor's expense with suitable material as specified in ODOT Item 203, "Roadway Excavation and Embankment" or Section 312323.13, "Compacted Backfill" in designated areas shown on the contract drawings or specified under this Section. Compaction requirements shall be in accordance with these specifications.

3.4 SHEETING AND SHORING

- A. The Contractor shall be responsible for supporting and maintaining all excavations required even to the extent of sheeting or shoring the sides and ends of excavations with timber or other satisfactory supports. If the sheeting, braces, shores, stringers, waling timbers, or other supports are not properly placed or are insufficient, the Contractor shall provide additional or stronger supports. The requirements of sheeting or shoring or of the addition of supports shall not relieve the Contractor of his responsibility for their sufficiency. All trench protection and sheeting and shoring must conform to the regulations of both the Ohio State Industrial Commission (OSIC) and the Federal Occupational Safety and Health Act (OSHA) and will be subject to their respective inspections. All orders of OSIC and OSHA representatives must be complied with by the Contractor.
- B. All sheeting and shoring shall be removed where and when required and, upon its removal, all voids filled. If any sheeting or shoring is ordered to be left in place, it shall be cut-off as directed. In compensation for the sheeting and shoring left in place, if any, shall be by prior written change order.

3.5 REMOVAL OF WATER

- A. All conduit shall be installed in a dry and stable trench. The Contractor may pump or otherwise remove any water, sewage, or other liquid that may be found or may accumulate in the trench.
- B. If, in the opinion of the Contractor, dewatering pumps and equipment are required to maintain a dry and stable trench, suitably sized pumps shall be provided to meet the requirements. The manner and spacing of well points shall be at the Contractor's discretion.

- C. Excess water shall not be considered reason for undercut of trench bottom.
- D. The Contractor shall maintain the pumps for the duration of their need including a satisfactory discharge outlet. Power for the pumps shall be electric unless otherwise approved by the Engineer. Noise abatement may be required for any on-site generators in residential areas.

3.6 BEDDING FOR LAYING CONDUIT

- A. Bedding shall conform to the requirements of the plan detail unless otherwise modified by the Engineer.
- B. All granular bedding material shall be compacted to 95 percent of maximum laboratory dry density.
- C. All pipe bedding shall be of the gradation(s) specified and be limestone. Slag may not be used and gravel may be used with permission of the Engineer.

3.7 LAYING CONDUIT

- A. Except as otherwise permitted by the Engineer, all conduit shall be laid starting at the outlet end. Pressure conduits may be laid from either direction however the joints shall be such that the bell is upgrade or toward normal pressure.
- B. Line and grade for gravity conduits shall be established by the use of sufficient means to maintain acceptable installation tolerances and allow for reasonable checking observation by the Engineer.
- C. Line and grade shall be established and maintained over a length of fifty (50) feet minimum. Cut sheets establishing grade at fifty (50) foot intervals shall be provided to the Engineer prior to beginning work.
- D. The Contractor shall provide sufficient equipment and workers to safely handle and lay all conduit included as part of this work. All storage of materials shall be in a manner as to avoid damage to either surface prior to placement.
- E. The Contractor shall inspect each piece of conduit prior to placement in the trench and any unsatisfactory conduit shall be rejected.
- F. Conduit shall not be laid in water, mud, or any otherwise unsuitable trench. The conduit shall not be pushed into or allowed to fall to the bottom of the trench. Handling of the conduit shall be in conformance to the manufacturer's recommendations.

- G. The conduit shall be kept clean and any open ends of installed conduit shall be closed when work is not in progress.
- H. Jointing of the conduit shall be in accordance to the requirements of the manufacturers and as required by the specification material type. Any deviation from these acceptable methods requires approval of the Engineer.
- I. Testing of joints, where required, shall be done in accordance with the Specification for Testing. Should any section fail to meet test requirements, the Contractor shall make suitable corrections, at their cost, until the requirements are met.

3.8 SERVICE CONNECTIONS

- A. In general, and as called for on the drawings, as required or as ordered, provision shall be made in the sewers for service connections by inserting a wye branch for each service connection with a branch size called for by the contract drawings but never less than six (6) inch, in the sewer at location shown, where required or ordered, for sewers to ten (10) feet in depth. For sewers exceeding ten (10) feet in depth, or indicated on the plans, the Contractor shall construct a riser, as per detail, in such manner, that the top of the riser shall be not less than seven (7) feet below grade or at such elevation as to properly receive the required service connection, with full regard to elevation of service sewer and slope from building or structure to the sewer which shall not be less than one percent (1%). Risers are to be encased in sonotube filled with No. 57 Limestone as shown on the contract drawings.
- B. The location of service connections is shown in a general way on the contract drawings. The Owner may also increase the number of connections or delete some connections as the sewer is being built, or increase the size of connections when it deems such advisable.

3.9 FINAL BACKFILL

- A. Final backfill shall be installed from the top of the Pipe Embedment to the final grade. Final backfill of all conduit trenches shall conform to the requirements of the plans and details, Section 312323.13 "Compacted Backfill", and Section 312323.14 "Compacted Granular Backfill". All final backfill under existing or proposed pavement or structures or within the 1:1 zone of influence of existing or proposed pavement or structures shall be "Compacted Granular Backfill". All final backfill not under existing or proposed pavement or structures or within the 1:1 zone of influence of proposed pavement or structures shall be "Compacted Backfill".
- B. Unless otherwise directed, all forms, bracing and lumber shall be removed during backfilling and the cavities and voids resulting from the removal shall be backfilled and compacted to 100% of Standard Proctor.

- C. The Contractor must use special care in placing backfill so as to avoid injuring or moving the conduit or structure when compacting the backfill.
- D. In areas used for temporary maintenance of traffic the top layer of final backfill from the elevation of the existing subbase base interface to the existing or proposed surface(s), shall be ODOT Item 304 Aggregate Base to provide a temporary surface traffic course.
- E. Should after settlement occur, the Contractor must add and compact additional material.
- F. Machine mounted mechanical tamper shall be used for backfill compaction. Flooding, jetting or puddling of backfill will not be permitted.
- G. Excavated material in excess of that needed for backfilling and all unsuitable material shall be disposed of by the Contractor at his own expense and the cost of such disposal shall be included in the unit or lump sum prices bid.

3.10 TESTING AND ACCEPTANCE

- A. Prior to final acceptance of the conduit or the placing of the conduit into service, testing and/or televising may be required.
- B. For all sanitary, water, or other pressured conduits, pressure testing shall be required in accordance to the specifications contained herein. Televising shall be required for all sanitary sewer and may be required for storm sewers as outlined or required by plan note.
- C. Final television inspection of conduit shall be performed by an experienced company and in a format satisfactory to the Owner. Televising shall be done in the presence of the Engineer unless so waived. The Engineer shall be provided with unedited video tapes and two (2) copies of the video log.
- D. Televising shall not be done until all known repairs are completed and the line has been suitably flushed.

3.11 SITE RESTORATION

- A. Restoration of the disturbed project area shall begin immediately after backfilling has been completed. All excess material, debris, and excavation shall be disposed of by the Contractor.
- B. Restoration of paved surfaces and of seeded areas shall be done as soon as conditions permit. The manner in which this work shall be done is defined in other specifications or the contract plans.

- C. While payment for site restoration may be included in other items, final acceptance of the underground conduit shall not occur until all work is complete. Where no separate pay items exist for restoration work, the Engineer may determine an appropriate value for this work to be retained until its completion.

END OF SECTION 312333

SECTION 312514.16 - EROSION CONTROL MATTING

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 SUMMARY

- A. This section includes provisions for the following items:

- 1. Temporary erosion control.
- 2. Permanent erosion control.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary erosion control.
 - 1. Erosion control fabric shall be Hold/Gro as manufactured by Erosion Control Systems, Inc or Engineer Approved Equal.
 - 2. Fabric characteristics
 - a. Material:
 - 1) Yarn - Photodegradable synthetic types

2) Filler - Biodegradable paper

b. Dimensional:

<u>Width</u>	<u>Length</u>	<u>Sq.Yds.</u>
56" + 1"	580'	300
113" + 1"	575'	600

B. Permanent erosion control.

1. Erosion control fabric shall be 7020 Enkamat, as manufactured by Basf Corporation Fibers Division or Engineer Approved Equal.

2. Matting characteristics

a. Material:

- 1) Nylon 6 + 0.5% by weight Carbon Black

b. Dimensional:

- 1) Weight (g/sq.m.) 405 $\pm$ 7%
- 2) Thickness (mm) (Minimum) 18 (0.8in.)
- 2) Width (cm) 97 (38 inc.)
- 3) Roll Length (m) 100 (330 ft.)
- 4) Filament Dia. (mm) (Minimum) 0.40

c. Tensile Properties:

- 1) ASTM 01682

d. Strength (kg/M - minimum):

- 1) Length Direction 140
- 2) Width Direction 80

e. Elongation (% - minimum):

- 1) Length Direction 50

2) Width Direction 50

f. Resiliency:

1) Immediate recovery
3 cycles at 100 psi 80

g. Exposure Properties:

1) Temperature range for 80%
strength retention -100° to 250°F
2) pH range for 80%
strength retention 3 to 12

PART 3 - EXECUTION

3.1 EROSION CONTROL MATTING

- A. Hold/Gro shall be placed over the slopes immediately following fine grading and seeding, on areas indicated on the drawings.
- B. Enkamat shall be placed on areas indicated on the drawings, immediately following placement and stapling of Hold/Gro.
- C. Install both Hold/Gro and Enkamat as per manufacturer's instructions and specifications.
- D. Stakes for Enkamat shall be pine.

END OF SECTION 312514.16

SECTION 321000- PAVEMENT REPLACEMENT

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 WORK

- A. The Contractor shall furnish all of the equipment, labor and materials necessary to install, replace, and/or restore existing pavement structures together with their respective appurtenances as shown on the plans and as specified herein. This work shall include all of the subgrade preparation, subbase, base, intermediate pavement course(s), and finish pavement courses together with curbing, guttering, tack and/or prime coating, sealing and other pertinent work as necessary to meet the conditions of this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 REPAIR OR REPLACEMENT WORK

- A. For the repair and/or replacement of all existing pavement structures and their respective appurtenances that are removed and destroyed or otherwise damaged by the Contractor in the course of his performance of the work required under this contract, the Contractor shall furnish all equipment, labor, and materials as necessary to properly restore to a condition equal to that at his entry, and to the satisfaction of the Engineer, the Ohio Department of Transportation, the County Engineer, City Engineer, all cinder, slag, gravel, water-bound macadam, bituminous macadam, asphalt and brick or concrete driveways, curbs, sidewalks and roadways in strict accordance with the drawings and as specified herein.
- B. In general, this item will include concrete, steel reinforcement, brick, stone, slag, cinders, gravel, asphalt and other bituminous materials and curbs, gutters, driveway culverts, road and curb drains and the demolition, excavation and removal of existing driveways, sidewalks and roadways.

1.5 REFERENCE TO OTHER PARTS

- A. Other sections of these specifications shall apply, as and where applicable to this section and such sections will be the same as though they were included in this section.
- B. For all old work where pavement is being repaired and/or replaced as a result of damages occurring thereto during the course of the work of this contract, all clearing and grubbing, removal and storage of topsoil, excavation and/or placing of compacted fill and granular backfill, shall be done as required under other parts of these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Generally, for all repair and replacement work, all new materials shall match the existing and adjoining work in both composition and quality unless otherwise ordered, specified herein, and/or shown on the drawings. In any stone driveway or roadway, the material used for stone fill shall conform to the existing material.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. All pavement work shall be done in strict accordance with the specifications of the governmental body concerned and the latest ODOT specifications as applicable or at the direction of the Engineer.
- B. All pavements disturbed by the Contractor's operations shall be relaid to the thickness of the adjoining pavement and, in all cases, the restoring of pavements, shall apply both to foundation courses and to the wearing surface.
- C. Should cracks or settlements appear in adjoining pavements, the paving shall be removed to the extent necessary to secure firm and undisturbed bearing and shall be replaced in a satisfactory manner.
- D. No permanent pavement shall be installed, repaired, and/or restored unless, or until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement.
- E. Where new or replacement concrete pavement or base is placed adjacent to existing concrete pavement or base, contraction joints shall be provided in the new or replacement pavement so as to form a continuous joint with that in the existing pavement.

3.2 ROADWAY SUBGRADE

- A. The entire area to be occupied by the roadways and parking areas shall be cleared, topsoil removed and stored, and the excavation or compacted fill made as required and brought to the proper cross-sections. Pipe trenches and other excavations shall be backfilled as required, and thoroughly compacted within the limits of the roadways or parking areas.
- B. After the surface of the subgrade has been properly shaped and before any stone or slag is placed, the entire subgrade shall be thoroughly rolled and compacted to a depth of 12 inches under this section. Rolling shall be done with an approved type of self-propelled roller, weighing not less than ten (10) tons. All hollows and depressions which develop during the rolling shall be filled with acceptable materials, and the subgrade rerolled. The process of filling and rolling shall be repeated until no depressions develop, and the entire subgrade has been brought to a uniform condition of stability.
- C. All places which, in the opinion of the Engineer cannot be properly rolled, shall be tamped with handheld mechanically or pneumatically powered tampers.
- D. In making the compacted fill and in doing the final subgrade rolling, the Contractor shall see that the material to be compacted and/or rolled has the proper moisture content to secure maximum compaction. When, in the opinion of the Engineer, the material is too wet, the compacting shall be delayed until the material has dried sufficiently. When, in the opinion of the Engineer, the material is too dry, the material shall be sprinkled with water in an amount to secure the proper moisture content.

END OF SECTION 321000

SECTION 321313.33 - PORTLAND CEMENT CONCRETE SEALING

PART 1 - SUBMITTALS

1.1 SUBMITTALS

- A. The Contractor shall submit technical information and a certified statement stating that the material to be furnished conforms to the material requirements of this section of the specifications.
- B. Copies of waybills and delivery tickets shall be submitted to the Contracting Officer during the progress of the work. Before final payment is allowed, the Contractor shall file with the Contracting Officer certified waybills and delivery tickets for all concrete sealer used in the work.

1.2. PORTLAND CEMENT CONCRETE SEALING TREATMENT

- A. The concrete sealer shall be an approved non-epoxy, non-silicone, non-toxic, non-hydrophobic, non-solvent material, and shall meet the following qualifications and AASHTO and ASTM test performance criteria, based in accordance with the manufacturer's recommended rate of coverage.

- 1. The penetrating sealer, after finished application, shall not darken, stain or discolor the treated concrete.
- 2. Application of the sealer shall not alter the surface texture or form a film or coating on the surface, and shall be compatible with the concrete pavement joint materials.
- 3. AASHTO T 259 Resistance of Concrete to Chloride Ion Penetration

Sealer-treated test specimens shall exhibit the allowing average values when an average of 0.125 inches of the treated concrete specimen has been abraded from the surface to simulate 10-12 years of traffic wear. Abrasion will be performed after treatment with sealer; and before ponding with chloride solution.

<u>Test</u>	<u>Duration</u>	<u>Average Absorbed CL</u>	<u>Method Used</u>
Salt water ponding	90 days	2.50 lbs. per cubic yard	AASHTO T259
	2160 hours	Depth of Measurement: 1/16" to 1/2" *	AASHTO T260
		0.04 lbs. per cubic yard	
		Depth of Measurement: 1/2" to 1.0"	

* Based on abraded concrete specimens.

4. ASTM C672 Scaling Resistance of Concrete Surfaces

Sealer-treated test specimens shall exhibit a 0 (zero) scale reading, and an improvement over untreated specimens after completion of a minimum of 50 freeze-thaw cycles; or until a difference between treated and untreated specimens develops. Example after 50 cycles:

<u>Specimen</u>	<u>Scale Rating</u>
Untreated	2+ (light to moderate scaling)
Treated	0 (no scaling)

5. AASHTO T161/ASTM C666 Resistance of Concrete to Rapid Freezing and Thawing

Treated specimens shall demonstrate equal or better durability to surface scaling than the frost resistant concrete used as a control upon completion of the test after a minimum of 300 freeze-thaw cycles. Example:

<u>Cycles</u>	<u>Control</u>	<u>Treated</u>
146	Slight	None
237	Slight	Slight
480	Slight	Slight

6. ASTM C501 Relative Resistance to Wear

Treated test specimens shall meet or exceed the improvement percentages as specified below on nominal 3,000 psi concrete after 1,000 revolutions:

<u>Specimen</u>	<u>Average Abrasive Wear Index</u>	<u>Average Depth of Wear</u>	<u>Average Absolute Weight Loss</u>
Treated	27.4	.026	3.227 gm
Untreated	19.9	.033	4.525 gm
Improvement	37.7%	21.2%	28.7%

7. ASTM C882 Bond Strength of Epoxy-Resin Systems used with Concrete

Test results shall demonstrate bond strength of treated samples equal to untreated samples used as a control.

8. Depth of Penetration

Depth of Penetration shall be a minimum of 1/8 in. as demonstrated by successful testing in accordance with AASHTO T 2590 (based on abroad specimens).

- B. The concrete sealer to be used shall be SINAK Concrete Sealer or approved equivalent. To be considered equivalent, the Contractor must submit the following with his bid. Products submitted after the bid date will not be considered.
 - 1. Verifiable evidence from approved independent laboratory(s) confirming that the material proposed for consideration meets or exceeds the test criteria of each and every test set forth in this specification. Any product that does not meet or exceed the results of all tests will not be considered.
 - 2. A written certification from the manufacturer that the material proposed for consideration meets all of the other requirements of this specification as listed in Paragraph B. above.
 - 3. The manufacturer's application instructions and procedures, and rate of coverage shall be included with all submittals for consideration.

1.3 SURFACE PREPARATION

- A. The Contractor shall prepare surfaces to be sealed by thoroughly cleaning same with mechanical sweepers of an approved type and with wire brooms where necessary. All surfaces to be treated shall be power washed with a high pressure washer. To be clean, the surfaces shall be free of sand, clay, dust, salt, grease, oil, curing compound, and other foreign matter which might adversely affect the penetrating capability of the sealer.

1.4 APPLICATION OF CONCRETE SEALER

- A. Equipment to be used shall be as recommended by the manufacturer and shall include a low pressure airless or gravity type sprayer with an application pressure of approximately 40 psi, using a spray tip large enough to deliver an even fan spray without misting.
- B. Application of the concrete sealer shall be recommended by the manufacturer and in accordance with the following:
 - 1. The application shall consist of two coats minimum. Each coat shall be in a light, even coat which shall be allowed to dry completely before continuing application. If a light sheen is visible when the second coat is dry, stop sealer application, and proceed to the water spray application.

If no sheen is visible when the second coat is dry, repeat coats until a light sheen is apparent. Immediately after the final seal coat has been applied and allowed to dry,

a light, even water-spray shall be applied to all treated surfaces to ensure complete penetration of the sealer. If a sheen is still visible after the water coat has dried, additional water coats shall be applied until the sheen is no longer evident and the concrete finish appears dull.

Coverage rate for SINAK Concrete Sealer S-102 will generally average 300-500 square feet per coat. The manufacturer or approved distributor will be present during the application of the first 1,000 square feet application to insure proper application procedures are followed. Based upon the first 1,000 square feet application, the manufacturer (or distributor) and the Project Engineer will agree upon a coverage rate to use for both coats within the range noted above.

2. Weather Limitations

Sealer should not be applied when temperatures are below 40°F or are expected to fall below 32°F within 24 hours or when rain is forecasted within 24 hours.

1.5. WARRANTY

- A. The Manufacturer shall provide a 5-year warranty that shall cover labor and material for damages from water, freeze/thaw, salt, acid rain, and from surface deterioration due to reinforcing steel corrosion or from ultra-violet exposure.
- B. The warranty shall be valid even if the treated surfaces is abraded off to a depth of up to 1/16-inch.
- C. The applicator shall be factory-trained and certified as competent, by the manufacturer with respect to the products specified herein. The applicator shall provide proof of certification.

Installation furnished by the factory certified applicator is required to qualify the project for the 5-year warranty.

END OF SECTION 321313.33

SECTION 321623 - CONCRETE WALKS AND STAIRS

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 WORK

- A. Under this section the Contractor shall furnish and construct sidewalks and stairs as shown or scheduled on the Drawings, specified or directed.
- B. This section includes preparation of the base and/or subgrade construction of walks, adjustment of manhole castings and valve boxes to conform to new elevations and other work and materials incidental to the construction of walks and stairs.

1.3 OWNER'S STANDARDS AND SPECIFICATIONS

- A. Items preceded by ODOT shall refer to the latest edition of the State of Ohio, Department of Transportation, Construction and Material Specifications.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. All concrete used shall be Class C as specified in section 030000.

2.2 WALKS AND STAIRS

- A. Other materials for walks and stairs shall meet the applicable requirements of ODOT Item 608.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All soil subgrade under walks and stairs shall be compacted in accordance with Section 310000.
- B. All service boxes, manholes and inlet tops shall be set to the required grades.

- C. All construction for walks and stairs shall be in accordance with ODOT Item 608 for the type called for on the Drawings.
- D. Minimum thickness of concrete walks shall be 4 inches.
- E. Stairs shall be as detailed on the drawings.

END OF SECTION 321623

SECTION 323113 - CHAIN LINK FENCING AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This work consists of the supply and installation of galvanized chain link fencing as called out on the plans and details.

1.2 SUBMITTALS

- A. Comply with all provisions of Section 013323, Shop Drawings and Submittals.
- B. Product Data: For the following:
 - 1. Submit manufacturer's technical data, and installation instructions for fencing, fabric, gates and accessories, for approval by the Owner's Representative.

0.1 QUALITY ASSURANCE

- A. Any subcontracted fence work shall be performed by a qualified firm specializing in fence work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions indicated for pipe and roll-formed are outside dimensions, exclusive of coatings.
- B. Products: Subject to compliance with requirements, fence is to be provided from one of the following sources:
 - 1. Galvanized Steel Fencing and Fabric:
 - a. Allied Tube and Conduit Corp.
 - b. Master - Halco
 - c. Merchants Metals, Inc.

2.2 STEEL FABRIC

- A. Fabric: Comply with Chain Link Manufacturer's Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 16' high. Wire size includes zinc coating with 2.0 oz. per square foot of surface, galvanized after weaving, or .4 oz. aluminized coating.

2.3 FRAMING AND ACCESSORIES:

A. Steel Framework, General: Galvanized Steel, ASTM A 120 or A 123 with not less than 1.8 oz. zinc per square foot of surface. All framework shall match fabric.

1. Fittings and Accessories: Galvanized Steel, ASTM A 153. All fittings and accessories shall match fabric.

B. End, Corner, and Pull Posts:

1. Up to 12' fabric height: 2.875" OD schedule 40 pipe weighing 5.79 pounds per linear foot, galvanized inside and out.

C. Line Posts:

1. 5' to 12' fabric height: 2.375" OD schedule 40 pipe weighing 3.65 pounds per linear foot, galvanized inside and out.
2. Up to 4' fabric height: 1.9" OD schedule 40 pipe weighing 2.75 pounds per linear foot, galvanized inside and out.

D. Top Mid-rail and Bottom Rail: In twenty-one or twenty-four foot lengths with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top and bottom rail securely to each gate corner, pull and end post.

1. 1.66" OD pipe, 2.27 pounds per linear foot.
2. Mid-Rail: Same as top and bottom rail and used when fence fabric is 10' and higher.
3. Provide manufacturer's standard galvanized steel rail end cup for each end.

E. Tension Wire: 7 gage, coated coil spring wire.

1. Locate at bottom of fabric if bottom rail is not specified.

F. Fabric Ties: 9-gage aluminum wire.

G. Hog Rings: 11 gage galvanized steel.

H. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

I. Post and line Caps: Provide weather tight closure cap for each post. Provide line caps with loop to receive tension wire or top rail.

- J. Tension or Stretcher Bar: One-piece lengths equal to full height of fabric, with minimum cross-section 3/16" x 3/4". Provide one for each gate and end post, and two for each corner and pull post.
- K. Tension or Stretcher Bar Bands: Space not over 15" o.c., to secure bars to end, corner, pull, and gate posts.
- L. Concrete for footers: ODOT items 499 and 511 (Class C, F, or S).

1.4 SWING GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8" apart unless otherwise indicated.
 - 1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" on center.
 - 2. Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
 - 3. Fabricate perimeter frames of minimum 1.90" OD pipe.
 - 4. All gates with a 6' opening or larger shall be double swing.
- B. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

<u>Leaf Width</u>	<u>Gate Post</u>	<u>lbs./lin. ft.</u>
Up to 6'	2.875" OD Pipe	5.79
Over 6' to 13'	4.000" OD Pipe	9.11
Over 13' to 18'	6.625" OD Pipe	18.97
Over 18'	8.625" OD Pipe	28.55

- C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:
 - 1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening.
 - 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 - 3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
 - 1. Fabric shall be applied to the 'security' side of framework. For sports facilities the 'security' side is the playing side of the framework. For other applications, the 'security' side is the outside of the framework.
- B. Excavation: Drill or hand excavate (using posthole digger) holes for posts to diameters and spacings shown.
 - 1. Posts shall be spaced a maximum of 10' on center.
 - 2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
 - 1. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hole in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.
- D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide one expansion coupling for every five couplings.
- E. Mid-Rails: Provide mid-rails as indicated. Install in one piece between posts, using line rail clamps necessary.
- F. Bottom Rail: Provide as indicated. Install in one piece between posts using line rail clamps where necessary.
- G. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- H. Tension Wire: Install tension wire at bottom of fabric. Fasten fabric to tension wire using hog rings 24" on center.
- I. Fabric: Leave approximately 1" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

- J. Tension or Stretcher Bars: Thread through and clamp to fabric and secure to posts with metal bands spaced 15" on center.
- K. Swing Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- L. Tie Wires: Tie fabric to line posts, with wire ties spaced 12" on center. Tie fabric to rails and braces, with wire ties spaced 24" on center. Tie fabric to tension wires, with hog rings space 24" on center.
- M. Fasteners: Use 5/16" x 1-1/4" galvanized carriage bolts with hex nut. Install so head of carriage bolt is on the 'secure' side of the fence.

END OF SECTION 323113

SECTION 330505.09 - PIPE JOINTS

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 WORK

- A. The installation of all piping, fittings, valves, hydrants, etc. in the performance of pipeline construction work shall include the making of one or more types of pipe joints as specified herein.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 PUSH-ON TYPE JOINTS

- A. Push-on type of joints for cast iron and ductile iron pipe shall be made where shown on the plans and as specified herein in strict accordance with the manufacturer's recommendations.
- B. No more than one joint at a time shall be "pushed home". In the event that two (2) or more joints are "pushed home" simultaneously, the Contractor shall remove all pipe which was not pushed home "one at a time" and remove and discard the "used" gaskets and relay the pipe "one at a time".
- C. Rubber gaskets shall be a rubber O-ring type shaped to fit the particular inside configuration of the bells of the pipe being installed and shall produce a leak-free piping system.

- D. Immediately prior to assembly, thoroughly clean all pipe surfaces which the rubber gasket contacts, insert the gasket properly and lubricate the joint surfaces.
- E. All ends shall be beveled and square to the pipe barrel and shall be kept in a straight and square alignment to the receiving bell during assembly.
- F. No weight will be allowed for nor payment made for the gasket or lubricant used, but the cost thereof shall be included in the unit price bid for compression joint cast iron and/or ductile iron pipe and fittings.
- G. All "job" cut pipe ends shall be ground, filed or otherwise properly worked on so as to be both square to the pipe barrel and beveled similar to "factory" finished pipe ends. There shall be no "burrs" on any part of the cut pipe end.

2.2 COMPRESSION JOINTS FOR PRESTRESSED CONCRETE CYLINDER PIPE

- A. Compression joints for prestressed concrete cylinder pipe shall be made in accordance with AWWA C301 and with the requirements of the particular item specification(s) for prestressed concrete cylinder pipe.

2.3 COMPRESSION JOINTS FOR ASBESTOS CEMENT PIPE

- A. Compression joints for asbestos cement pipe shall be made in accordance with the requirements of AWWA C400 for asbestos cement pipe. All pipe ends, pushing home methods, pipe cutting, etc. shall be similar to that specified in the foregoing specifications.

2.4 FLANGED JOINTS FOR CAST IRON/DUCTILE IRON PIPE AND FITTINGS

- A. All flanged joints shall be thoroughly bolted with through stud or tap bolts of required size. Full face type rubber gaskets of an approved quality equal in all respects to "Rainbow" gaskets one-eighth (1/8) inch thick as manufactured by the U.S. Rubber Company shall be used in all flanged joints. All bolt heads and nuts shall conform in dimensions to the American Standard heavy series and nuts shall be hexagonal cold pressed with well fitting threads. Bolts and nuts shall be cadmium plated by an approved process with a plate thickness of 0.0003 to 0.0005 inches. In lieu of cadmium plating, galvanizing will be acceptable. All studs shall be made from silicon bronze ASTM B 124 with bronze nuts where used in contact with any liquid or buried underground or as called for on the contract drawings.
- B. All nuts and bolts that come into contact with water shall be painted with two (2) heavy coats of Inertol No. 49 thick or approved equal, made for bolts, studs, nuts or gaskets used for flanged joints, and the cost thereof shall be included in the unit price bid for flanged cast/ductile iron pipe and flanged cast/ductile iron fittings.

2.5 FLANGED JOINTS FOR STEEL CYLINDER PIPE

- A. Flanged joints for pre-stressed concrete cylinder pipe and for steel pipe shall be installed as shown on the drawings. Flanges shall be either cast steel, forged or rolled steel, or properly welded and machined fabricated steel plates welded to pipe cylinder with two (2) continuous welds. They shall have plain faces and shall be faced true and smooth at right angles to the axis of the pipe and shall be spot faced on the back. Drilling shall conform to ANSI one hundred twenty-five (125) pound standards. All bolts for flanges and for other types of bolting shall conform to ASTM A 307, Grade A, except where one or both flanges are cast iron, in which case bolts shall be Grade B.
- B. All bolts used in the finished work for flanges and tied joints for concrete pipe shall be of medium open hearth or electric furnace steel. The ends of all bolts must be finished to a standard radius in an acceptable manner. All screw threads shall be American Standard Coarse Thread (N.C.). Stud bolts shall be used to make the flanged joints on pipe.

All nuts shall be hexagonal, cold pressed, semi-finished and made of medium open hearth, electric furnace or Bessemer process steel. All dimensions shall be according to American Standard Heavy. Bolts and nuts shall be galvanized before shipment and not primed. Gaskets for flanged pipe shall be full faced rubber one-eighth (1/8) inch thick equal to Rainbow Style 9 as manufactured by the U.S. Rubber Company.

- C. All forged or rolled steel pipe flanges shall conform to ASTM A 181, Class 60.
- D. All structural steel shall conform to ASTM A 36.
- E. Iron castings must be smooth and free from blowholes and other defects and the material shall conform to ASTM A 48, Class 30 B.

2.6 MECHANICAL JOINTS

- A. All mechanical joints shall be thoroughly bolted in accordance with the manufacturer's recommendations with cadmium plated tee head bolts and nuts of high strength, heat treated cast iron or other approved materials having a minimum yield strength of forty- five thousand (45,000) pounds per square inch and an ultimate tensile strength of seventy thousand (70,000) pounds per square inch. Gaskets for sludge, gas, waste lines, etc., shall be plain rubber gaskets coated with Thickol or ASTM D 2000, Type SA-710, or equal. Gaskets for water service shall be plain rubber gaskets made of first grade plantation rubberin accordance with ANSI A21.11. Glands shall be of high strength cast/ductile iron.

- B. Where connections are made between wrought iron pipe and mechanical joints, an approved type of transition gasket and fitting shall be used in the mechanical joint in accordance with the manufacturer's standards and recommendations.
- C. All "job" cut pipe ends shall be ground, filed or otherwise properly worked on so as to be both square to the pipe barrel and beveled similar to "factory" finished pipe ends. There shall be no "burrs" on any part of the cut pipe end.
- D. Joint bolts shall be tightened by the use of approved wrenches and to a tension recommended by the pipe manufacturer. Overstressing of bolts to compensate for poor installation practice shall not be permitted.
- E. If sections of pipeline are "preassembled", at a location other than the intended final resting location of the piping, so as to include a fitting or line valve, the Contractor shall handle such "preassembled" sections so as to avoid deflections greater than allowed in published data normally provided by the respective pipe manufacturer. Such sections shall be limited in length to include no more than a standard length of pipe plus one (1) fitting and shall contain no more than two (2) preassembled joints. Any excessively deflected "preassembled pipe" shall be disassembled, the gaskets shall be discarded, and the preassembly (if it be repeated) all at the Contractor's risk and expense.
- F. Where joints are underground, bolts and nuts shall be stainless steel Type 316.
- G. Where shown on the drawings, or ordered, mechanical joints shall be provided with approved harnesses to effect tied joints.
- H. No special payment will be made for lock type joints, glands, bolts, nuts or gaskets used for mechanical joints, but the cost thereof shall be included in the unit price bid for mechanical joint cast/ductile iron pipe and mechanical joint cast/ductile iron fittings. Payment on a tonnage basis will be based on the body weight of the pipe or fittings only and will not show additional weight of accessories.
- I. Approved harnesses to effect tied joints will be paid for as a part of their respective pipeline construction.

2.7 BALL AND SOCKET JOINTS

- A. Ball and socket joints shall be made where shown on the drawings and shall conform to AWWA C111 and shall be subject to the approval of the Engineer.
- B. Ball and socket joints shall be as manufactured by Clow Corporation, American Cast Iron Pipe Company or equal.

2.8 GROOVED-END JOINT COUPLINGS

- A. Grooved-end joint couplings for ductile iron piping shall be used where indicated on the drawings. Grooved and joint couplings shall be watertight, and designed for the working pressures specified for the piping system with which they are to be used. Couplings shall be self-centering and shall engage and lock in place the grooved pipe and pipe fitting ends, in a positive couple. Where grooved-end joint couplings are shown on the drawings, pipe grooves shall be located such as to provide a flexible-type joint which provides for linear and angular movement. Coupling housing clamps shall be fabricated in two or more sections of malleable iron castings, conforming to the requirements of ASTM A 47, Grade 32510. Coupling gaskets shall be molded synthetic rubber, conforming to ASTM D 2000, Grade 3BA615A14-B13. Bolts shall be oval neck, track head type, with hexagonal heavy nuts conforming to ASTM A 183. Grooved, hinged flange adapters, with gaskets, shall be furnished for making valve or flanged connections, and shall be constructed of the same materials as used for the couplings.
- B. Pipe grooving shall be done by the manufacturer and in accordance with the pipe coupling manufacturer's specifications.
- C. Field grooving of pipe shall not be permitted, except for occasional field make-up pieces when permitted by the Engineer.
- D. Grooved-end joint couplings shall be Victaulic, Dresser or equal.

2.9 BOLTLESS RESTRAINED JOINT

- A. Boltless restrained joints shall be used where called for on the drawings or as directed by the Engineer to provide restraint against external forces or against separation due to internal pressure.
- B. Types of boltless restrained joints acceptable are "Super-Lock" by Clow Corporation, "Flex-Ring" by American Cast Iron Pipe Company, "TR-Flex" by United States Pipe and Foundry Company or equal.

PART 3 - INSTALLATION (NOT APPLICABLE)

END OF SECTION 330505.09

SECTION 330505.30 - LEAKAGE TESTING

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 WORK

- A. The Contractor shall perform sufficient tests to determine that the installation of all pipe materials have been as specified and that test results are in accordance with those required for approval of the installation.
- B. The Contractor shall furnish all pressure gauges, suitable pump or pumps, pipes, test heads, and any other apparatus and materials used for these tests. These tests are to be considered as part of the work, and no additional compensation shall be made.
- C. The tests shall be conducted under the direction of the Engineer or an appointed agent. Any testing done without direction and supervision as specified shall not be considered as a proper means of approval.
- D. The Contractor may obtain water for testing as may be required by observing the rules and regulations enforced in the municipality in which the work is being done.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

PART 2 - INFILTRATION AND EXFILTRATION TESTING

2.1 GENERAL

- A. All sanitary sewers shall be tested using an exfiltration test or, where specifically allowed in writing by the Engineer, an infiltration test.
- B. All sanitary sewers shall be tested. No visible leakage in the sewers or manholes shall be permitted.

- C. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
- D. Bulkheads shall be used to isolate the test sections as required to perform the work. All service laterals, stubs and fittings shall be plugged or capped at the connection to the test section.

2.2 INFILTRATION TESTING

- A. An infiltration test shall be conducted for all sections of sewer, only when the ground water level is two (2) feet or more above the elevation of the inside crown of pipe at the upstream limit of the section being tested.
- B. The use of well point pumps or other dewatering devices shall have been discontinued for 24 hours prior to testing to permit the groundwater table to return to a static condition.
- C. The leakage rate shall be measured by a weir, by determination of the time required to fill a container of known volume, or other measuring device approved by the Engineer in the lower end of the sewer section to be tested.
- D. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.

2.3 EXFILTRATION TESTING

- A. The test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the sewer or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.
- B. The exfiltration test shall be conducted between two manholes by sealing the downstream end of the test section and all inlet sewers at the upstream manhole with pipe stoppers.
- C. The average internal pressure in the system shall not exceed 11.6 feet of water or 5 psi and the maximum internal pipe pressure at the lowest end shall not exceed 23 feet of water or 10 psi.
- D. Water shall be added to the pipe section at a steady rate from the upstream manhole to allow air to escape from the sewer until the water is at the specified level above the crown of the pipe. The water may stand in the pipe and manhole up to twenty-four (24) hours prior to measurement of leakage to allow for absorption by the pipe and bleeding of air. After absorption into the pipe and manhole has stabilized, the water in the upstream manhole shall be brought to test level.

- E. The leakage rate shall be determined by measurement of the drop in water elevation measured in the upstream manhole and the loss of water calculated. The test period shall be a minimum of sixty (60) minutes duration. Use the following table to determine loss of water as measured in the manhole:

WATER LEVEL CHANGE IN TEST MANHOLE		<u>VOLUME OF LEAKAGE</u>	
		4' DIA. M.H.	5' DIA. M.H.
<u>(INCHES)</u>	<u>(FEET)</u>	<u>(GALS.)</u>	<u>(GALS.)</u>
1/8	0.01	0.98	1.53
1/4	0.02	1.96	3.06
3/8	0.03	2.94	4.59
1/2	0.04	3.92	6.12
5/8	0.05	4.90	7.65
3/4	0.06	5.87	9.18
7/8	0.07	6.85	10.71
1	0.08	7.83	12.24
1-1/8	0.09	8.81	13.77
1-1/4	0.10	9.79	15.30
1-3/8	0.11	10.77	16.83
1-1/2	0.12	11.75	18.36
1-5/8	0.13	12.72	19.89
1-3/4	0.14	13.71	21.42
1-7/8	0.16	14.69	22.9
2	0.17	15.67	24.48

- F. When twenty-three (23) feet or more difference in grade occurs between manholes, the low air pressure test method shall be used instead of an exfiltration test.

2.4 ALLOWABLE LEAKAGE

- A. The maximum allowable leakage for either infiltration or exfiltration shall be 100 gallons per inch of internal pipe diameter per mile per day.
- B. If actual leakage measured exceeds the limits specified, the Contractor must locate and repair or remove and replace the defective pipe sections to the satisfaction of the Engineer and retest the section accordingly at no additional cost to the Owner.

2.5 MANHOLES

- A. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one hour test.

PART 3 - LOW PRESSURE AIR TESTING

3.1 GENERAL

- A. Sanitary sewers twenty-four (24) inches and less may be air tested as specified.
- B. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
- C. If the low pressure air test is being conducted on more than one (1) manhole run of pipe, the entire section being tested shall meet the low pressure air test requirements as if only one (1) of the manhole reaches in the section were being tested.
- D. The sewer shall be flushed and cleaned prior to testing to clean out any debris and to wet the pipe surface for more consistent results.
- E. The section of pipe to be tested shall be plugged at each end and the ends of laterals, stubs and fittings to be included in the test section shall be plugged to prevent air leakage, and securely braced to prevent possible blowouts.
- F. Test equipment consists of valves and pressure gages to control air flow and to monitor pressure within the test section.

3.2 EQUIPMENT

- A. Equipment used shall meet the following minimum requirements and be approved by the Engineer:

1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
2. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
3. All air used shall pass through a single control panel.
4. Three (3) individual hoses shall be used for the following connections:
 - a. From control panel to pneumatic plugs for inflation.
 - b. From control panel to sealed line for introducing the low pressure air.
 - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

3.3 PROCEDURES

- A. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used for the test. The sealed pipe shall be pressurized to 5 psig. The plugs must hold against this pressure without having to be braced.
- B. After a manhole to manhole run of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be slowly introduced into this sealed line until the internal air pressure reaches approximately 4 psig greater than the average ground water back pressure.
- C. In areas where ground water is known to exist, the Contractor must determine the average ground water back pressure. The Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sanitary sewer lines entering the manhole.

This shall be done at the time the sanitary sewer line is installed or install an 8-inch diameter stand pipe outside of the manhole backfilled with a column of clean stone of 2-inch minimum diameter to subgrade. Immediately prior to the performance of the low pressure air test, the ground water back pressure shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be vertical and a

measurement of the height, in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. This height, divided by 2.307, will equal the average groundwater back pressure.

- D. At least two (2) minutes shall be allowed for the air to stabilize when the specified internal air pressure has been obtained. When the pressure has stabilized and is at or above 3.5 psig, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average groundwater back pressure calculated) shall not be less than the time in the tables in the following references:

ASTM C828 for clay pipe, ASTM C924 for concrete pipe and for other materials test procedures as approved by the Engineer.

- E. If a one (1) psi drop in pressure does not occur within the test time, the line has passed. If the pressure drop is more than one (1) psi during the test time, the line is presumed to have failed the test. If the line fails the test, segmented testing may establish the location of any leaks.
- F. The Contractor must repair the leak or remove and replace the defective pipe section and re-test the section to the satisfaction of the Engineer at no additional cost to the Owner.

3.4 SAFETY

- A. The pneumatic plugs must be installed in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug, which is partially deflated before the pipe pressure is released, can be dangerous.
- B. Pressurizing equipment shall include a regulator, ranging from 1 to 10 psi, to avoid over pressurizing and damaging an otherwise acceptable line.
- C. No one shall be allowed in the trench or manholes during testing.
- D. Plugs shall not be removed until all pressure has been released.

3.5 MANHOLES

- A. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one-hour test.

PART 4 - HYDROSTATIC TESTING

4.1 GENERAL

- A. The pipe to be tested must be sufficiently backfilled to prevent movement while under test pressure.
- B. Joint restraint at fittings should be permanent and constructed to withstand test pressure. If concrete thrust blocks are used, sufficient time must be allowed before testing to permit the concrete to cure. A cure time of seven (7) days is recommended when Type I Portland cement is used; three (3) days is recommended when Type III high-early Portland cement is used.
- C. Test ends should be restrained to withstand the appreciable thrusts that are developed under test pressure.
- D. Air pressure testing of installed pressure pipe is expressly prohibited.
- E. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.

4.2 FORCE MAINS

- A. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight. After the pipe is laid and before backfill is placed around the joints, such lengths of the force main as determined by the responsible agency shall be tested under a hydrostatic pressure of 1.25 times the working pressure at the highest point along the test section, but, in no case, shall such force mains be tested at less than 100 pounds per square inch.
- B. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a booster pump connected to the pipe in a manner satisfactory to the Engineer. The duration of the test shall be for a minimum of sixty (60) minutes.
- C. No pipe installation will be accepted unless the leakage rate for the section of pipe being tested does not exceed a rate of 75 gallons per 24 hours per mile per inch of nominal diameter.
- D. The Contractor shall furnish suitable means for determining the quantity of water lost by leakage during the test.

4.3 WATER MAINS

- A. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The water may be introduced from lines in service through valved connections or by temporary connections to hydrants or to taps made in the new line or at the connection in the line cap. All such connections should be made at the lowest possible point in the line. The method of obtaining and placing test water into the water main shall be approved by the Engineer.
- B. Flow velocity during line filling should not exceed two (2) feet per second. All air should be expelled from the pipeline during filling and again before making either pressure or leakage tests. Automatic air release valves are recommended.
- C. The test pressure shall be 1.25 times the working pressure at the highest point along the test section or 150 psi whichever is higher unless otherwise specified elsewhere in these specifications or directed by the Engineer. In no case should pressure exceed rating of pipe, valves, fittings or appurtenances, whichever is less.
- D. The test pressure shall be maintained for a sufficient length of time to allow a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.
- E. In cold weather, immediately after testing a section of the water main piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances if the water main is exposed.
- F. Every precaution must be taken to remove, valve off or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury.
- G. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as specified herein.
- H. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.
- I. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.
- J. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C600 shall govern the test. Allowable leakage, as set by AWWA standard, is based on 150 psi test pressure and a leakage rate of 12 gallons per day per mile of pipe per inch of pipe diameter.

- K. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with these specifications.
- L. The lack of hydrants, branch shut-off valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shut-off valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retested.

END OF SECTION 330505.30

SECTION 330505.43 – DEFLECTION TESTING

PART 1 - GENERAL

1.1 PIPE TO BE TESTED

- A. All thermoplastic gravity sanitary sewer pipe shall be tested for allowable deflection.

1.2 TIMEFRAME FOR TESTING

- A. Deflection tests shall be performed before final acceptance and no sooner than thirty (30) days after installation of final backfill

1.3 ALLOWABLE DEFLECTION

- A. Maximum allowable pipe deflection shall be five (5) percent of the average inside diameter for the size and class of pipe specified.

1.4 DESCRIPTION OF WORK

A. EQUIPMENT

1. Acceptance testing shall be performed with a non-adjustable “go, no-go” mandrel with a minimum of eight (8) contact points. Adjustable mandrels for acceptance testing shall be used only with permission of the Engineer.
2. The mandrel size shall be ninety-five (95) percent of the average inside diameter for the size and class of pipe specified.
3. If the "go, no-go" mandrel will not pass through a section of pipe a deflectometer or adjustable mandrel may be used to determine the extent and/or severity of the non-acceptable area. A “go, no-go” mandrel shall be re-run through the pipe section for final acceptance testing at no additional cost to the Owner.

B. TESTING

1. The contractor or subcontractor performing the test shall be experienced and qualified to perform deflection testing with the equipment and procedures utilized. The contractor shall provide all labor, materials, tools and equipment necessary to clean and test all sections of sewer pipe, locate deficient areas, repair, deficient areas, and retest all repaired areas.
2. All sewer runs shall be cleaned prior to testing.

3. The acceptance test shall be performed without mechanical pulling devices.

1.5 REPAIR OF DEFECTIVE PIPE

- A. All pipe failing the deflection test shall be exposed and repaired or replaced as approved by the Engineer at no additional cost to the Owner.

END OF SECTION 330505.43

SECTION 330519 - DUCTILE IRON PIPE

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all ductile iron pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All ductile iron pipe shall conform to AWWA C151 with the ends being designed for one of the type joints as specified herein.
- B. To assure that the iron is suitable for satisfactory drilling and cutting, the chemical constituents shall meet the physical property recommendations of ASTM A 536.
- C. The minimum wall thickness of the pipe barrel shall be that indicated in ANSI A21.50 (AWWA C150) for laying condition "2", 150 psi internal working pressure and a surge pressure of 100 psi and 5 ft. depth of cover unless otherwise indicated on the drawings. ANSI A21.50 (AWWA C150) CLASS 52 shall be the minimum thickness class for ductile iron pipe furnished under this specification unless otherwise shown on the drawings.

2.2 COATING AND LINING

- A. The outside surface of all ductile iron pipe shall be shop coated with either a coal tar or asphalt base bituminous material. If this coating material is found to be damaged prior to the pipe trench being backfilled, the Contractor shall provide and apply additional

material of that required to repair the damages. The Contractor shall have sufficient coating material available at the job site prior to laying the pipe.

- B. The interior of the pipe shall be lined with cement mortar and seal coated in complete conformance with ANSI A21.4 (AWWA C104).

2.3 JOINTS

- A. Mechanical Joints and Push-on Joints including their respective appurtenances shall conform to ANSI A21.11 (AWWA C111).
- B. Flanged Joints shall conform to AWWA C110 or ANSI A21.10. Flanged joints shall not be installed underground except within structures as indicated on plans or directed by the Engineer.
- C. Appurtenances used to make flanged joints shall include: one-eighth (1/8) inch thick rubber gaskets, bolts having American Standard Heavy Unfinished Hexagonal Head and Nut dimensions in conformance with ANSI B18.1, and material for bolts and nuts shall conform to ASTM A 575 or A 576.
- D. Ball and socket joints (river crossing) shall be restrained, boltless and capable of deflecting up to 15 degrees and shall be installed in accordance with the manufacturer's recommendations.

2.4 POLYETHYLENE ENCASEMENT

- A. The ductile iron pipe, fittings and appurtenances buried underground, shall be encased with 8 mil polyethylene film conforming to AWWA C105, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with AWWA C600.
- B. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the properly cementing the joints.
- C. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.
- D. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 330519

SECTION 330519.03 - CAST GREY IRON/DUCTILE CAST IRON FITTINGS

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all cast grey iron/ductile iron fittings of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All standard and special cast grey iron/ductile iron castings shall conform to the latest applicable AWWA and/or ANSI specifications for pressure fittings with end conditions as specified herein. AWWA C110 (ANSI A21.10) shall be applicable for all cast grey iron/ductile iron fittings.

2.2 PRESSURE RATINGS

- A. Fittings for pipe sizes of 12-inch diameter and smaller shall be rated for 250 psi working pressure and fittings for pipe sizes of 14-inch diameter and larger shall be rated for 150 psi working pressure in accordance with AWWA C110. Fittings for higher working pressures will be noted on the plans.

2.3 END CONDITIONS

- A. The end conditions of each fitting shall be as required to accommodate the jointing requirements for the particular pipe material being connected to the fitting in accordance with the piping layout shown on the plans. The particular pipe material to be connected to the fitting is specified elsewhere in these specifications.

2.4 COATING AND LINING

- A. The outside surface of all cast grey iron/ductile iron fittings shall be shop coated with either a coal tar or asphalt base bituminous material. If this coating material is found to be damaged prior to the pipe trench being backfilled, the Contractor shall provide and apply additional material of that required to repair the damages. The Contractor shall have sufficient coating material available at the job site prior to laying the pipe.
- B. The interior of each fitting shall be lined with cement mortar and seal coated in complete conformance with ANSI A21.4 (AWWA C104).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All fittings shall be installed at the locations and grades shown on the plans or as directed by the Engineer. Mis-located fittings shall be relocated to the required location by the Contractor at his own expense.
- B. All joints shall be made in accordance with these specifications.
- C. Thrust restraint shall be provided in accordance with the plans and specifications.

END OF SECTION 330519.03

SECTION 330531.16 – PVC PIPE (AWWA C900)

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all PVC pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All PVC pipe used, as covered under this section, shall conform to AWWA C900, with end being designated for one of the type joints as specified herein.
- B. The outside diameter of the pipe shall be identical to that of ductile iron pipe for similar diameters, requiring no special adaptors to allow the use of cast or ductile iron fittings where necessary.
- C. The minimum class for PVC pipe under this Item shall be DR 18.
- D. Materials of construction, including joints and gaskets, shall be suitable for exposure to raw sewage, and shall also be UV stabilized with either 2% carbon black or titanium dioxide.

2.2 JOINTS

- A. Mechanical Joints and Push-on Joints including their respective appurtenances shall conform to ANSI A21.11 (AWWA C111).
- B. Flanged Joints shall conform to AWWA C110 or ANSI A21.10. Flanged joints shall not be installed underground except within structures as indicated on plans or directed by the Engineer.
- C. Appurtenances used to make flanged joints shall include: 1/16 in. thick red rubber gaskets, bolts having American Standard Heavy Unfinished Hexagonal Head and Nut dimensions in conformance with ANSI B18.1, and material for bolts and nuts shall conform to ASTM A 575 or A 576.
- D. Ball and socket joints (river crossing) shall be restrained, boltless and capable of deflecting up to 15 degrees and shall be installed in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the properly cementing the joints.
- B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.
- C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 330531.16

SECTION 330533.23 – HDPE PIPE (AWWA C901)

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all HDPE pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All HDPE pipe used, as covered under this section, shall conform to AWWA C901.
- B. The minimum class for HDPE pipe under this Item shall be DR 7.
- C. Materials of construction shall be suitable for exposure to raw sewage, and shall also be UV stabilized with 2% carbon black.

2.2 JOINTS

- A. Shall be fusion joined, conforming ASTM D2657.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed.
- B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.
- C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 330533.23

SECTION 331413 - WATERLINE CONSTRUCTION

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 WORK

- A. This work shall consist of the construction of a potable water pipeline in accordance with these specifications and in reasonably close conformity to the lines and grades indicated on the plans or as established by the Engineer. This work shall include excavating for pipe, fittings, valves, thrust blocks and other appurtenances, clearing and grubbing and the removal of all materials necessary for placing the pipe, except removals listed separately; furnishing and placing granular or concrete bedding and granular backfill as required, constructing and subsequently removing all necessary cofferdams, cribs, and sheeting, pumping and dewatering, making all pipe joints as required, installing all necessary pipe, joining to existing and proposed appurtenances as required, performing leakage tests as specified, disinfecting and restoration of disturbed facilities and surfaces. Arrangements for and the performance of the adequate and satisfactory disposal of all test and disinfection waters shall be the Contractor's responsibility. The Contractor shall chlorinate the water main as often as necessary to achieve an approved potable water test.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe, fittings, specials, valves, joint materials, hydrants, thrust blocks, backfill and other appurtenances shall be the size and kind specified in the proposal and shown on the plans.

PART 3 - EXECUTION

3.1 LAYING PIPE

- A. The Contractor shall furnish all of the proper tools and equipment required for the safe, proper handling and laying of all pipe, fittings, and specials that are to be installed in this work. All storage, handling, laying, and backfill methods shall be performed so as to avoid damaging either the interior or the exterior surfaces of all pipe fittings, specials, joint materials, or other appurtenances, and any such damage shall be remedied at the Contractor's expense.
- B. Before any pipe is lowered into the trench, it shall be inspected for damage, and any unsatisfactory lengths shall be rejected. Cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended. The interior and exterior of each pipe length used shall be cleaned as necessary to remove all dirt or other foreign material before it is inspected. The interior of the pipe shall be kept clean until the work is accepted.
- C. No pipe shall be laid in water, mud or when trench conditions or weather is unsuitable for such work.
- D. If mud, surface water, leaves and/or other debris have been permitted to enter the strung-out pipe, the inside shall be cleaned with a strong hypochlorite solution after all such foreign materials are completely cleaned from the pipe and before the pipe is lowered into the trench.
- E. Pipe shall not be pushed off the bank nor shall it be permitted to fall into the trench. Each type of pipe, fitting, special or other appurtenances shall be handled in strict accordance with recommendations of its respective manufacturer.
- F. No rocks, stones, metal, concrete, bricks, pavement pieces, wood, soil lumps or other hard materials too big to pass through a six (6") inch screen shall be permitted within six (6") inches of the pipe after it is laid in the trench. Any pipe endangered by such debris shall be subject to removal and disposal at the Contractor's expense.
- G. When pipe laying is not in progress, the open ends of installed pipe shall be closed by appropriate means to prevent the entrance of dirt and water. In the event ground water, sewage water or other potential contaminants enter any portion of the pipeline, after it is laid, cleaning and preliminary disinfection with a strong hypochlorite solution shall be done.
- H. Pipe lengths shall not be deflected at the joint to any greater degree than recommended by the manufacturer of the particular joint being used. Where deflections in excess of such recommendations are necessary, the appropriate specifications for the particular type

of pipe being installed shall govern the mode of accomplishing such excessive deflections.

3.2 JOINTING PROCEDURES

- A. The particular method of making up pipe joints shall be governed by the type of pipe material and type of joint in accordance with the drawings and/or specifications.

3.3 ANCHORAGE

- A. All hydrants, plugs, caps, tees and bends shall be provided with a reaction backing or shall be restrained by attaching suitable metal rods, clamps, anchored fittings or harnessed joints, as shown on the plans or as specified so as to prevent movement.
- B. Reaction backing shall be of concrete, with steel reinforcement as required, unless otherwise shown on the drawings. Backing shall be placed between solid ground and the fitting or other part of the pipeline to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that as indicated on the plans. The backing shall be so placed unless otherwise directed, that the pipe and fitting joints will be accessible for repair.
- C. Steel tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing. Steel tie rods or clamps shall be used to connect the hydrant watch valves to the main and to connect the hydrant to the water valves when shown on the drawings. Steel rods or clamps shall be painted with three coats of an approved bituminous paint or coat tar enamel.

3.4 BACKFILLING

- A. Backfilling shall be accomplished in a two-step procedure as follows: 1) partial backfill before leakage tests, and 2) completion of backfill after tests. Departure from this procedure due to traffic or other conditions shall be approved by the Engineer.

3.5 MAINTENANCE OF EXISTING DITCHES

- A. The Contractor shall use the utmost care in maintaining ditches and other waterways, and, if either bottoms or banks of such ditches are disturbed, they shall be promptly restored and maintained for the life of the guaranty period. Similar care shall be used in preventing damage to existing pavement by caving of trench walls and undermining such pavement. If pavement is damaged, the Contractor shall repair same at his own expense.

3.6 CLEARING SITE AND RESTORING DAMAGED SURFACES

- A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish.
- B. Unless otherwise called for on the plans, the Contractor shall replace all pavement, sidewalks, sod, or other surfaces disturbed to a condition equal to that existing before the work was started, furnishing all materials, labor, equipment, etc., at no additional cost to the Owner.
- C. All restoration of lawns shall be performed in accordance with these specifications as a part of performing the work as specified herein.
- D. All restoration of driveways, sidewalks, roadways and shoulders (berms) shall be in accordance with these specifications as a part of performing the work as specified herein.
- E. Upon completion of the foregoing work, all tools and other property belonging to the Contractor shall be removed, and the site shall be left in good condition.

3.7 LEAKAGE TESTS

- A. All pipeline construction shall be subjected to hydrostatic leakage testing of each valved section, as it is completed, unless otherwise directed by the Engineer. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight.
- B. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The method of obtaining and placing test water(s) into the pipeline shall be approved by the Engineer.
- C. The test shall be observed by the Engineer or his designate. The Owner will furnish a pressure gauge for measuring the pressure on the water main. The Contractor shall furnish a suitable pump, pipes, bulkheads and all appliances, labor, fuel, and other appurtenances necessary to make these tests.
- D. The test pressure shall be maintained for sufficient length of time to allow for a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.
- E. The Contractor shall drain each section of the waterline piping after it has been tested. If the drains are connected to valve or drain vaults, then, within a reasonable period of time after the test has been completed, the Contractor shall pump all water out of the vaults.
- F. In cold weather, immediately after testing a section of the waterline piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other

precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances.

- G. Every precaution must be taken to remove, valve-off, or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury thereto.
- H. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as herein required.
- I. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.
- J. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.
- K. The test pressure shall be 250 psi unless otherwise specified elsewhere in these specifications. Testing procedure shall be as specified herein for the particular pipe material contained in the section tested and shall be subject to modification as required by a particular pipeline material specification or part thereof, as contained elsewhere in these specifications.
- L. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C 600 shall govern the test, except that the allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.
- M. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with the foregoing.
- N. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.
- O. The lack of hydrants, branch shutoff valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shutoff valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retests.

- P. The Contractor shall provide all pressure test equipment. The Owner shall provide all test water required and shall provide test gauges.

3.8 DISINFECTION

- A. Prior to disinfection, all pipeline construction shall be flushed to remove any foreign material. Flushing shall be performed after completion and approval of the leakage tests. The minimum requirements for flushing are as follows:

<u>Pipe Size</u>	<u>Minimum GPM Required</u>
6"	220
8"	390
10"	610
12"	880
14"	1,200
16"	1,565
18"	1,980
20"	2,450
24"	3,500

- B. Flushing at these rates shall be continued for at least five (5) minutes. In the event the foregoing requirements cannot be met due to the Owner's facilities being inadequate, alternate rate(s) and duration(s) of flushing shall be used.
- C. Disinfecting water mains shall be in accordance with AWWA C 651 and as specified herein.
- D. The following disinfectants may be used: Chlorine or chlorine water; calcium hypochlorite; sodium hypochlorite solution, or chlorinated lime-water mixture. Chlorine shall be applied at one extremity of a pipe section via a corporation stop (installed in the top of the pipe by the Contractor) and bled at the opposite extremity of a properly segregated section. Precautions shall be taken to prevent dosed water from flowing into the potable water supply. All high points on the section treated shall be properly vented for air escape.

- E. The rate of applying the disinfectant shall provide at least 25 ppm (mg per liter) chlorine dose at the outlet end of the line section being treated. The disinfecting period shall be twenty-four (24) hours, and, at the end of this period, a chlorine residual of at least 10 mg per liter shall exist at the outlet end of the line.

In the event of unfavorable or unsanitary conditions of installation, poor packing, or high pH, the period of disinfection may be extended. For shorter periods of disinfection, higher dosages shall be required.

- F. Sterilizing water shall be disposed of in a satisfactory manner by the Contractor. If the foregoing disinfection procedure fails to provide thorough disinfection of the line, it shall be repeated as necessary in the pipeline for a period of 20 - 30 days after it is placed into operation.
- G. Tests for efficacy of sterilization shall be made by the Owner, and repeated sterilization shall be carried out by the Contractor when required.
- H. Contractor shall provide all disinfectants and disinfection equipment. Owner shall provide all test waters needed.

3.9 DISINFECTION (ALTERNATE METHOD)

- A. Application of disinfectant may be performed as follows:
 - 1. While installing the main, a powdered calcium hypochlorite compound (HTH, perchloron, monochlor, or equal), shall be placed in the main at intervals such that the minimum quantity of disinfectant per 100 feet of main is as follows:

4" pipe	1 oz.
6" pipe	2 oz.
8" pipe	3 oz.
10" pipe	5 oz.
12" pipe	8 oz.
16" pipe	12 oz.
20" pipe	18 oz.
24" pipe	25 oz.

- B. Although the foregoing alternate method of disinfection precludes the performance of leakage tests and flushing prior to disinfection, the requirements pertaining to the disinfection period, requisite chlorine residual, repeating the disinfection procedure, leakage tests and flushing shall be met.

END OF SECTION 331413

SECTION 333100.02 - SANITARY AND/OR STORM SEWER CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish, install and test sewers in conformance with the contract drawings, specifications (ODOT Item 603), and the conditions contained herein.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary and/or storm system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with sanitary and/or storm work similar to that required for project.
- C. Codes and Standards:
 - 1. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of sanitary and/or storm system's materials and products.
 - 2. Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to sanitary and/or storm systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for sanitary and/or storm system materials and products.
- B. Shop Drawings: Submit shop drawings for sanitary and/or storm systems, showing piping materials, size, locations, and inverts. Include details of underground structures, connections, and manholes. Show interface and spatial relationship between piping and proximate structures.

- C. Record Drawings: At project closeout, submit record drawings of installed sanitary and/or storm sewage piping and products, in accordance with requirements of Division 1.
- D. Maintenance Data: Submit maintenance data and parts lists for sanitary and/or storm system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 SAFETY

- A. For the security or safety of persons in and adjacent to trenches or construction operations, the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America and the safety regulations of the Department of Industrial Relations of the State of Ohio shall be followed when specifically applicable, or by similarity of operation or as necessary for adequate protection. Further the Contractor shall comply with the applicable requirements of the Occupational Safety and Health Act.

1.6 SUBSURFACE CONDITIONS

- A. The Contractor shall make whatever test holes he deems necessary, in accordance with these Specifications, to determine the subsurface ground conditions, including the presence of water and rock. No extra compensation shall be allowed the Contractor as the result of subsurface conditions encountered within the project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe, fittings, specials, manholes, joint materials, thrust blocks, and other appurtenances shall be the size and kind specified in the proposal and shown on the plans.

PART 3 - EXECUTION

3.1 LINE AND GRADE

- A. All excavation shall be done to the lines and grades as shown on the plans. Any changes in the plan lines and/or grades must be approved in writing by the Engineer prior to making said changes. Adjustments in horizontal and/or vertical alignment can be made only at manholes.

3.2 CLEARING AND GRUBBING

- A. The Contractor shall clear the work areas of all trees, shrubs, hedges, plants and flowers as directed by the plans or the Engineer. All refuse and rubbish shall be cleared from the work area and all tree stumps shall be grubbed out. All cleared material and stumps shall be removed from the work area and disposed of in a manner approved by the Engineer. No extra compensation will be allowed the Contractor for this work.

3.3 REMOVAL OF TOPSOIL

- A. When directed by the Engineer, the Contractor shall remove from the work area all loam, topsoil and sand found suitable for future top dressing or use, after clearing, but prior to starting main excavations.
- B. Such material shall be removed in such a manner that it is clearly separated from the underlying material and shall be stored in such a manner and location as directed by the Engineer.

3.4 UNAUTHORIZED EXCAVATIONS

- A. All excavations made outside of the lines and grades established by the Engineer, including the excavation, handling, rehandling, backfilling and disposal of such material shall be performed at the Contractor's own expense. This shall include that work caused by cave-ins, slides, swellings or upheavals. All spaces beneath foundations of structures, utilities, pipes or other existing facilities shall be filled with concrete or other acceptable material.

3.5 SHEETING AND SHORING

- A. The Contractor shall be responsible for supporting and maintaining excavation required by the Contract even to the extent of sheeting and shoring the sides and ends of excavations with timber, steel sheeting, or approved metal boxes. If the sheeting and shoring is not properly installed or is insufficient, the Contractor shall provide additional and/or stronger supports. The Contractor shall at all times be responsible for the sufficiency of the sheeting and shoring utilized.
- B. After the pipe has been laid and when the backfilling is high enough to make it safe to remove the sheeting and bracing, the Contractor shall do this work in such a manner as to prevent damage by caving or settling of the trench walls. While the sheeting is being removed, the voids left after pulling the sheeting shall be refilled with earth or granular material compacted into place with special tools, flooding, or other methods if acceptable to the Engineer.
- C. Whenever in the opinion of the Engineer, it is necessary for protection of the work or adjoining property, the sheeting and bracing, or any part of same, shall be left in the trench

and all projecting sheeting shall be cut off two feet below the surface of the ground, and the cost of doing such work will be paid for at the rate of One Hundred Dollars (\$100.00) per thousand feet, board measure. No payment will be made for wasted ends.

3.6 REMOVAL OF WATER

- A. The Contractor shall at his own expense do all pumping, bailing, ditching and draining necessary to keep the excavation reasonably dry and free from water or other liquids regardless of whether it may originate from his own Contract, from other Contracts, from the ground or from existing pipes and conduits. Water so removed shall be discharged at such distance from the excavation that there will be no possibility of its returning or making wet unsuitable conditions about the work. The Contractor shall be liable for any damage caused by his removal of water or other liquids.
- B. No water will be allowed to enter the pipe nor will any pipe joints be made under water.

3.7 EXCAVATION

- A. Sewer trenches must be excavated with vertical sides from the bottom of the trench to one (1) foot above the top of the sewer, from which point sides may slope to ground surface, except that in streets or roadway, trenches must be excavated with vertical sides to the top of the trench. Width of trench in the vertical section shall be excavated only as wide as necessary to provide free working space on each side of the sewer according to the size of the sewer and the character of the ground; but in every case there shall be sufficient space between the sewer and the sides of the trench to make it possible to thoroughly ram the backfilling around the sewer and to secure tight joints, but in no case less than nine (9) inches on either side of the pipe. In no case, however, shall the width of the trench at the top of the sewer exceed the dimensions as shown on the contract drawings. In no case will it be permitted to excavate sewer trenches with sides sloping to the bottom.

3.8 LAYING PIPE

- A. The Contractor shall furnish all of the proper tools and equipment required for the safe, proper handling and laying of all pipe, fittings, and specials that are to be installed in this work. All storage, handling, laying, and backfill methods shall be performed so as to avoid damaging either the interior or the exterior surfaces of all pipe fittings, specials, joint materials, or other appurtenances, and any such damage shall be remedied at the Contractor's expense, as approved or directed by the Engineer.

- B. Before any pipe is lowered into the trench, it shall be inspected for damage, and any unsatisfactory lengths shall be rejected. Cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended. The interior and exterior of each pipe length used shall be cleaned as necessary to remove all dirt or other foreign material before it is inspected. The interior of the pipe shall be kept clean until the work is accepted.
- C. No pipe shall be laid in water, mud or when trench conditions or weather is unsuitable for such work, except by permission of the Engineer.
- D. If mud, surface water, leaves and/or other debris have been permitted to enter the strung-out pipe, the inside shall be cleaned as directed by the Engineer and before the pipe is lowered into the trench.
- E. Pipe shall not be pushed off the bank nor shall it be permitted to fall into the trench. Each type of pipe, fitting, special or other appurtenances shall be handled in strict accordance with recommendations of its respective manufacturer.
- F. No rocks, stones, metal, concrete, bricks, pavement pieces, wood, soil lumps or other hard materials too big to pass through a six inch (6") screen shall be permitted within six inches (6") of the pipe after it is laid in the trench. Any pipe endangered by such debris shall be subject to removal and disposal at the Contractor's expense as and when directed by the Engineer.
- G. When pipe laying is not in progress, the open ends of installed pipe shall be closed by appropriate means to prevent the entrance of dirt and water.
- H. Pipe lengths shall not be deflected at the joint to any greater degree than recommended by the manufacturer of the particular joint being used. Where deflections in excess of such recommendations are necessary, the appropriate specifications for the particular type of pipe being installed shall govern the mode of accomplishing such excessive deflections. All pipe deflections shall be performed only with the Engineer's approval.

3.9 JOINTING PROCEDURES

- A. The particular method of making up pipe joints shall be governed by the type of pipe material and type of joint in accordance with the drawings and/or specifications.

3.10 ANCHORAGE

- A. All force mains, and sewers where shown on the drawings shall be provided with a reaction backing or shall be restrained by attaching suitable metal rods, clamps, anchored fittings or harnessed joints, as shown on the plans or as specified so as to prevent movement.

- B. Reaction backing shall be of concrete, with steel reinforcement as required, unless otherwise shown on the drawings. Backing shall be placed between solid ground and the fitting or other part of the pipeline to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that as indicated on the plans. The backing shall be so placed unless otherwise directed, that the pipe and fitting joints will be accessible for repair.
- C. Steel tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing. Steel rods or clamps shall be painted with three coats of an approved bituminous paint or coal tar enamel.

3.11 BACKFILLING

- A. Backfilling shall be accomplished in a two-step procedure as follows: 1) partial backfill before leakage tests and 2) completion of backfill after tests. Departure from this procedure due to traffic or other conditions shall be approved by the Engineer.
- B. All backfill in trenches under street pavements shall be thoroughly compacted as specified, using approved mechanical tampers or jetting equipment before replacing any pavements, either permanent or temporary. Backfill may be sprinkled if necessary at the time of backfilling to maintain the optimum moisture content at the time of compaction.

3.12 TESTING OF BACKFILL COMPACTION

- A. Testing of the quality of the backfill compaction shall include either of the herein specified methods depending upon which backfill method was used by the Contractor. The following specified field tests shall be completed by an independent laboratory and testing firm approved by the Engineer.
 - 1. If the backfill was compacted using mechanical tamping equipment, the following compaction testing method will be used. A nuclear densometer shall be on site for the compaction testing of the eight inch (8") loose lift layers as they are compacted. The time of testing and location shall be as selected by the Engineer.
 - 2. Or, a "dutch cone" soil compaction testing procedure with a minimum of one (1) test hole per three-hundred (300) feet of trench backfilled. The location of the test hole shall be selected by the Engineer.

3. Pavement replacement shall not occur until one of the above tests have been completed and the results have been certified by the testing firm and received and reviewed by the Engineer.

3.13 CONTROL OF SEWER GRADE

- A. Grade and line stakes shall be set at regular intervals not to exceed 25 feet at any convenient offset from the centerline of the pipe. Batter boards shall be carefully placed immediately following the excavating equipment and a continuous check on trench depth shall be maintained. Suitable equipment for measuring from a line drawn taut over the batter boards shall be supplied by the Contractor. Such line shall be carefully located on the batter boards at the specified offset. In no event will pipe be laid unless a minimum of three (3) batter boards are in place and checked.
- B. If the Contractor elects to use a laser system for line and grade control, the equipment proposed for use must be approved by the Engineer. The Contractor shall submit a description of the equipment he proposes to use together with catalog data describing the function and the conditions of operation of the equipment. The Engineer shall have the right to disapprove the use of the proposed equipment if in his opinion such equipment will not provide a reliable control system.
- C. The Engineer shall have the authority to require that the laser setting be checked for accuracy at any time. In no case shall the laser equipment be set up for use without a positive check against established elevations. A positive check shall be interpreted to be a simultaneous observation of two (2) established grade hubs (3 point check). The elevations of sewer shall be checked during construction at regular intervals not to exceed 50 feet. The purpose of this check will be to assure that the laser system is functioning properly and that the sewer is being constructed to the proper line and grade.
- D. If the laser equipment is of the type which operates above grade, the instrument must be set up by sighting a target at the next upstream manhole. Whenever possible, a backsight shall be maintained in place if the equipment is designed with this feature.

3.14 TRENCH EXCAVATION

- A. Trenches shall be excavated with vertical sides from the bottom of the trench to twelve (12) inches above the top of the pipe from which point sides may slope to ground surface if no damage is caused to any adjacent structures, utilities or other existing facilities. The trenches shall be no wider than is necessary to perform the necessary work. The maximum width of trench shall be equal to the pipe inside diameter plus twenty-four (24) inches for pipe up to twenty-four (24) inches and the pipe inside diameter plus thirty (30) inches for pipe over twenty-four (24) inches, unless prior approval has been received from the Engineer or unless otherwise specified on the plans. If, for any reason, excessive

trench width occurs at depths which would impose critical loads on the pipe, the Contractor shall provide gravel or stone backup, extra strength pipe or concrete encasement as may be directed by the Engineer, at no additional cost to the Owner.

- B. Where the sewer is located adjacent to, or in the pavement, the Contractor shall be required to maintain vertical sides on all trenches using full sheeting and bracing if necessary. Maximum top width of trench permitted under such conditions shall be four (4) feet, plus the inside diameter of the pipe unless otherwise specified on the plans or prior approval has been received from the Engineer.
- C. In no case will it be permitted to excavate pipe trenches with sides sloping to the bottom.

3.15 BOTTOM PREPARATION

- A. The bottom of the trench shall be excavated to a depth of not less than one-fourth (1/4) the nominal pipe diameter, and in no case less than four (4) inches in earth and six (6) inches in rock below the intended elevation of the bottom of the pipe so that granular material may be placed for the pipe bedding.
- B. The trench shall be excavated to whatever depth below the bottom of the pipe, in excess of the minimum of four (4) inches, is necessary to provide adequate pipe support.
- C. The word "rock" wherever used as the name of an excavated material, shall mean boulders and solid masonry larger than one-half cubic yard in volume, of solid ledge rock and masonry which, in the opinion of the Engineer, required for its removal drilling and blasting, wedging, sledging or barring, or breaking up with a power-operated hand tool. No soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel; no loose, shaken or previously blasted rock or broken stone in rock fillings or elsewhere; and no rock exterior to the minimum limits of measurement, which may fall into the excavation, will be measured or allowed when extra payment for rock excavation is set forth.
- D. All loose material shall be removed for the trench bottom and a bed prepared using granular material similar to #67 stone or slag.
- E. The "bottom man" or "pipe layer" shall carefully prepare the bed for the pipe both from a grade and line standpoint. All rock or stones protruding above the prepared bed shall be removed so that in no case will rock touch the pipe.

3.16 ADDITIONAL EXCAVATION

- A. The sewers are to be built on good foundation. Such measures as necessary and as directed by the Engineer shall be used to prevent settlement. If, in his opinion, the material forming the bottom of the grade of the sewer is not suitable for foundation, a

further depth shall be excavated and the same filled with a suitable material. Authorized excavation below grade to be paid for in accordance with provisions of the General Conditions. Extra payment will be allowed to cover the actual cost of the fill material delivered to the site for all authorized excavation below grade.

3.17 UNAUTHORIZED EXCAVATIONS

- A. All excavations made outside of the line and grades established by the Engineer, including the excavation, handling, rehandling, backfilling and disposal of such material shall be performed at the Contractor's own expense. This shall include that work caused by cave-ins, slides, swellings, or upheavels. All spaces beneath foundations of structures, utilities, pipes or other existing facilities shall be filled with concrete or other acceptable material.

3.18 PIPE BEDDING

- A. The pipe bedding and backfill to twelve (12) inches above the pipe shall be with material in accordance with the provisions of the specifications for compacted backfill.
- B. All backfill above the height of twelve (12) inches above the top of the pipe shall be made by sliding the backfill down onto previously placed backfill. In no instance shall the backfill be machined or bucketed directly onto the twelve (12) inch layer of compacted backfill.
- C. No cinders, ashes, coarse shale or rock shall be placed in contact with any pipe or fittings.
- D. In the event sufficient suitable backfill material is not available from the excavated material, the Contractor shall haul in such soil from borrow pits provided for by himself and at his own expense.
- E. The Contractor shall consolidate the backfill in such a manner as will insure the minimum possible settlement and the least interference with traffic. Where sewers are located in or adjacent to pavements, all backfilling and materials handling equipment shall have rubber tires.

3.19 PIPE INSTALLATION

- A. The laying of pipe in finished trenches shall commence from the lowest point, with the spigot ends pointing in the direction of flow. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered, so that when laid they will form a sewer with uniform invert.

- B. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material shall be clean and dry. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of water tightness required.
- C. In the event that pipe previously laid is disturbed due to any cause, the same shall be taken up, the joints cleaned and the pipe relaid in accordance with the foregoing specifications. Trenches shall be kept water-free and dry during laying, bedding and jointing for as long a period as required to give a watertight joint.
- D. After the pipe is laid, graded and aligned, the bedding materials shall then be brought up to the springline of the pipe for the full width of the trench using granular material so placed as to fill the space under the lower part of the pipe. The remaining side fill and the backfill to a point 12 inches over the top of the pipe shall be made with the same granular material or in accordance with the requirement for trench backfill herein.

3.20 COMPACTED BACKFILL

- A. Compacted backfill, where indicated on the drawings or as directed by the Engineer, shall be spread in layers not to exceed six (6) inches in thickness and thoroughly tamped or compacted by mechanical tampers or equal.

Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of pipe settlement, misalignment and damage to joints. All driveways and pavement crossings which have been "open cut" are to have compacted backfill, as is the pipe bedding material a depth of not less than one-fourth (1/4) the nominal pipe diameter, and in no case less than four (4) inches below the bottom of the pipe in earth and six (6) inches below in rock to the springline of the pipe as shown on the Construction Detail and the pipe backfill to twelve (12) inches above the top of pipe and trench backfill in other areas where directed by the Engineer or indicated on the drawings.

- B. Pipe bedding shall be granular material equivalent to #67 slag or limestone. Pipe backfill shall be hand-placed, hand-selected material. Trench backfill shall be fine, granular material or equivalent when compacted backfill is required.

- C. No compacted backfill shall be made with frozen materials nor when the materials already in place are frozen. No compacted backfill shall be machined or bucketed directly onto the pipe but shall be placed upon previously placed compacted backfill.
- D. If any compacted backfill settles below grade prior to the release of the Contractor's guarantee retainer, the Contractor shall build up the low spots with approved, compacted material at his own expense.
- E. Material shall be taken from the side of the trench for compacted backfilling purposes only when, in the Engineer's judgement, it is proper to do so.

3.21 ORDINARY BACKFILLING

- A. After the completion of the pipe laying and prior to testing, if required by the Engineer, or deemed advisable by the Contractor, sufficient backfill shall be placed over the pipe between joints to resist uplift caused by the internal test pressure. Further backfilling shall be in a manner approved by the Engineer with slight mounding at the ground surface. Periodical dressing of fill over the trench to improve drainage and safety conditions shall be made during the course of the Contract.
- B. All materials used for ordinary backfilling shall be the best of the excavated material containing no perishable or objectionable material, frozen earth, debris, earth with an exceptionally high void content, or stones larger than three (3) inches in diameter.

3.22 TESTING OF BACKFILL COMPACTION

- A. The Engineer may test the backfill placed by the Contractor by the use of a nuclear densimeter, "dutch cone" testing, or other accepted method deemed appropriate.
- B. Granular material used for bedding and special backfill shall be compacted to 98% of its maximum dry density. All other backfill material shall comply with the following Table:

Max. Lab. Dry Wt.	Min. Comp. Require.
<u>lbs./cubic feet</u>	<u>% of Dry Wt.</u>
90-104.9	102%
105-119.9	100%
120 and over	98%

3.23 SERVICE CONNECTIONS

- A. In general, and as called for on the drawings, as required or as ordered, provision shall be made in the sewers for service connections by inserting a tilted-up "T" or "Y" Branch for each service connection with a branch size called for by the contract drawings but never less than six (6) inch, in the sewer at location shown, where required or ordered, for sewers to ten (10) feet in depth. For sewers exceeding ten (10) feet in depth, or indicated on the plans, the Contractor shall construct a riser, as per detail, in such manner, that the top of the riser shall be not less than seven (7) feet below grade or at such elevation as to properly receive the required service connection, with full regard to elevation of service sewer and slope from building or structure to the sewer which shall be not less than one percent (1%). Risers are to be encased in brick or concrete as shown on the contract drawings and/or Standard Details.
- B. The location of service connections is shown in a general way on the contract drawings. The Owner may also increase the number of connections or delete some connections as the sewer is being built, or increase the size of connections when it deems such advisable. Concrete for encasement of risers and of supporting pipe shall be placed in a manner to preserve alignment and avoid disturbance of joints.
- C. The terminus of each lateral shall also be marked by a "wye pole." The "wye pole" shall be of 2" x 2" hardwood such as oak, beech, etc. and shall be placed and maintained during backfilling in a truly vertical position at the exact end of the lateral with the upper end of the "wye pole" ending one foot below the existing ground or the finish grade whichever is lower. Tree limbs, branches or non-uniform pieces of construction lumber shall not be considered suitable for use as "wye poles".

3.24 PROTECTION OF SEWER

- A. After the sewer or drain is completed and trench backfilled, the Contractor shall maintain barricades and keep traffic off freshly backfilled trenches until the backfill has consolidated, but in no event shall traffic be permitted on backfill in less than seventy-two (72) hours after the trench has been properly backfilled and compacted.

3.25 INSPECTION BEFORE ACCEPTANCE

- A. In addition to being inspected by the Engineer during construction, each section of sewer, between each pair of manholes shall be inspected as soon after completion as possible and again before final acceptance by the Owner. Such inspection shall be visual when the sewer is too small to be entered, by looking through the sewer from manhole to manhole with the aid of reflected sunlight or by the use of powerful electric torch. The pipe shall be true to both line and grade; shall show no leaks; hydraulics of the sewer shall be in no ways impaired; there shall be no projections of connecting pipe into the sewer;

sewer shall be free from cracks, broken bells, and protruding joint materials; and shall contain no deposits of sand, dirt, or other materials which will in any way reduce the full cross-sectional area.

- B. All wall joints in manholes, junction chambers, pumping stations and elsewhere, shall be tight. All furnished work shall be neat in appearance, of first class workmanship, and all details shall conform to contract, detail, shop or working drawings from which no deviation will be permitted without written authority from the Engineer. Proper stoppers and bulkheads must be in place where required.
- C. If, as the result of any inspection, before final acceptance of the work, it is found that any section of any sewer has unduly settled, that joints have opened up or when the jointing material has come loose and projects into the sewer, or if pipes or bells are found cracked, broken or misshaped beyond accepted standards, or if any other defects are found in the sewers or in any of their appurtenances which might impair the satisfactory performance of the sewer or which show non-conformance with the drawings or Specifications, the Contractor shall cause such effective or inferior work to be promptly removed and replaced or satisfactorily repaired by proper material and workmanship without extra compensation for the labor, equipment and materials required.
- D. Should the Engineer require that any work be uncovered because of suspected failure or non-conformance or for inspection or other cause, and if such work is subsequently found satisfactory, the cost involved for such work will be paid for at the unit price bid for the respective items of work involved.

3.26 PIPE TESTING AND FINAL INSPECTION - SANITARY SEWER ONLY

- A. The Contractor shall test completed sanitary sewers in accordance with the provisions for exfiltration and infiltration testing as specified herein.
- B. All sanitary sewers, including completed manholes and lateral connections, must pass both an exfiltration test and infiltration test after construction has been completed, the sanitary sewers and manholes cleaned, and the manholes inspected and found satisfactory.
- C. As a demonstration of the workmanship and materials proposed to be used, the Contractor shall test the first section before proceeding with further construction. After the first section passes test, construction may resume. The testing operation shall be continuous throughout the construction of the projects and at no time during construction shall there be more than four (4) sections tested.
- D. EXFILTRATION TEST:

1. The exfiltration test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the main or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.
2. Make-up water shall be added at fifteen (15) minute intervals to the original test water level to maintain a constant head. The duration of the test shall be ninety (90) minutes, if loss is accelerating, or sixty (60) minutes, if constant or decelerating, as determined by the Engineer. The maximum allowable rate of loss shall be 200 gallons/inch diameter of sewer/mile/24 hours.

E. INFILTRATION TEST:

1. An infiltration test shall then be conducted for all sections of sewer having a groundwater elevation higher than that of the sewer, using the normal groundwater condition after the use of well point pumps or other dewatering devices has been discontinued for a period of time sufficient to permit the groundwater table to return to a static condition. The test shall be made by sealing off a section of sewer and measuring the infiltrate for a definite period of time. Measurements shall be by a weir or determination of time to fill a container of known volume. The method used must meet with the approval of the Engineer.

- F. Air testing sanitary sewers may be used if acceptable to the Owner and approved by the Engineer prior to testing. The Contractor shall submit a detailed air testing procedure with his request to the Engineer for approval.

3.27 FINAL INTERIOR INSPECTION

- A. After the sewers have been completed and tested they will be subject to a video tape inspection by a firm approved by the Engineer before they are accepted for service. The cost for such inspection shall be included in the unit cost for the sanitary and/or storm sewer. They will be inspected for grade, alignment and cleanliness. Any broken pipe shall be replaced. All porous pipe with leakage through the barrel or pipe with obvious leakage through the joints shall be removed and replaced or repaired. The pipe interior shall be free of all obstructions of debris that would interfere with flow. All replacement, repair or cleaning shall be done by the Contractor at the Contractor's expense.
- B. Any section of sewer previously tested may be retested by the Owner by the infiltration method under existing conditions before it is accepted for service. All underdrains or dewatering equipment shall be stopped and the groundwater level allowed to return to normal. Infiltration into the completed sewer, including service lines with backfill in

place, shall not exceed 200 gallons per inch of diameter per 24 hours per mile of sewer being tested under natural groundwater levels obtained.

3.28 STORM SEWER TELEVISIONING

- A. Prior to final payment for and acceptance of the storm sewer installation, the sewer shall be televised.

3.29 MAINTENANCE OF EXISTING DITCHES

- A. The Contractor shall use the utmost care in maintaining ditches and other waterways, and, if either bottoms or banks of such ditches are disturbed, they shall be promptly restored and maintained for the life of the guaranty period. Similar care shall be used in preventing damage to existing paving by caving of trench walls and undermining such paving. If paving is damaged, the Contractor shall repair same at his own expense.

3.30 CLEARING SITE AND RESTORING DAMAGED SURFACES

- A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish.
- B. Unless otherwise called for on the plans, the Contractor shall replace all pavement, sidewalks, sod, or other surfaces disturbed to a condition equal to that existing before the work was started, furnishing all materials, labor, equipment, etc., at no additional cost to the Owner.
- C. All restoration of lawns shall be performed in accordance with these specifications as a part of performing the work as specified herein.
- D. All restoration of driveways, sidewalks, roadways and shoulders (berms) shall be in accordance with these specifications as a part of performing the work as specified herein.
- E. Upon completion of the foregoing work, all tools and other property belonging to the Contractor shall be removed, and the site shall be left in good condition.

3.31 NOISE, DUST AND ODOR CONTROL

- A. The Contractor's performance of this Contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

3.32 CLEANING-UP, MAINTENANCE AND DISPOSAL OF MATERIALS

- A. Immediately after a section of sewer is tested and accepted for payment, the ground surface shall be cleaned of all surplus material including stones, broken pipe, construction material, and all other debris by the Contractor, to the satisfaction of the Engineer.
- B. All material excavated in trenching and all materials used in construction of the work shall be deposited so as not to endanger the work or create unnecessary annoyance to the public. During the progress of the work, all material piles shall be kept trimmed up and maintained in a neat workmanlike manner.
- C. A selected portion of the excavated materials will be used for backfilling or filling. Excavated material in excess of that needed for backfilling shall be disposed of by filling in spoil areas designated by the Owner. Such spoil material shall be rough graded to the lines and elevations directed by the Engineer.
- D. The Contractor shall be responsible for the condition of the pipe and trenches for a period of one-year from the date of the final estimate.

3.33 EXPOSING EXISTING UTILITIES AND STRUCTURES

- A. Where existing utilities and structures are indicated as being in the line of the proposed sewer, the Contractor shall expose them, as directed by the Engineer. This work is to be done sufficiently in advance of the construction operations to permit adjustment in line or grade, if required, to eliminate interferences. Existing pipes or conduits crossing the sewer trench, or otherwise exposed shall be adequately braced and supported to prevent trench settlement from disrupting the line or grade of the pipe or conduit, all in accordance with the directions of the Engineer. The Contractor shall keep fire hydrants and other public and private utility valves accessible at all times.
- B. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the Engineer, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by sewer construction and subsequently repaired must be properly maintained by the Contractor.
- C. Where it is necessary to relocate an existing utility or structure the work shall be done in such a manner as is necessary to restore it to a condition equal to that of the original facility. No such relocations shall be done until approval is received from the authority responsible for the utility or structure being changed.
- D. If an interference is encountered at grade with utilities or structures not shown on the plans or otherwise indicated, the compensation for the elimination of the interference shall be determined by the General Conditions.

3.34 MEASUREMENT

- A. Lineal feet of mainline sewer shall be determined by the difference in "as-built" stationing between centerlines of structures.
- B. Lineal feet of laterals shall be determined by actual measurement from the centerline of the mainline sewer to the end of the lateral.

END OF SECTION 333100.02

SECTION 333113 – PVC PIPE (SDR 35 & PS-46)

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all PVC pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. PVC pipe under this Item shall be SDR-35 or PS46. Pipe with a nominal diameter of 4” through 15” shall be considered SDR-35 and pipe with a nominal diameter of 18” through 24” shall be considered PS-46.
- B. PVC SDR-35 pipe, as covered under this section, shall conform to ASTM D 3034, with end being designated for one of the type joints as specified herein. PVC compounds shall conform to ASTM D 1784.
- C. PVC PS-46 pipe, as covered under this section, shall conform to ASTM F679, with end being designated for one of the type joints as specified herein. PVC compounds shall conform to ASTM D 1784.

- D. Materials of construction, including joints and fittings, shall be suitable for exposure to raw sewage, and shall also be UV stabilized with either 2% carbon black or titanium dioxide.

2.2 JOINTS AND FITTINGS

- A. Bell and spigot type joints, including their respective appurtenances shall conform to ASTM D 3212. Gaskets shall be in accordance with ASTM F 477.

2.3 INSTALLATION

- A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the proper cementing of the joints.
- B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.
- C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.
- D. Installation shall conform to ASTM D 2321.

END OF SECTION 333113

SECTION 333126 - PVC PIPE (PRESSURE RATED)

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 WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all PVC pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. **PRODUCT DATA:** Submit manufacturer's technical data and applications instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pressure rated polyvinyl chloride pipe (PVC), shall be the Standard Dimension Ratio as shown on the Drawings.
- B. PVC pipe and fittings shall fully comply with the latest revisions of ASTM D 2241. Polyvinyl chloride pipe shall be manufactured from rigid polyvinyl chloride compounds conforming to ASTM D 1784, Class 1245-A or 1245-B.

2.2 JOINTS

- A. Polyvinyl chloride pipe joints shall be integral bell push-on type meeting the requirements of ASTM D 3139. Gaskets shall be rubber ring type meeting the requirements of ASTM F 477.

- B. Mechanical joint cast iron fittings for PVC pipe meeting all requirements of ANSI A21.11 (AWWA C111) may be used in lieu of PVC pipe fittings.
- C. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be of stainless steel Type 316.
- D. Nuts and bolts which will be in contact with sewage shall be stainless steel, Type 316.
- E. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A 307, Grade B. Higher strength bolts shall be acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the properly cementing the joints.
- B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.
- C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 333126

SECTION 352016 - SLUICE GATES AND SLIDE GATES

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 WORK

- A. This section includes the furnishing and installation of wall thimbles, gate frames, sluice gates, slide gates, floor stands, extension stems, stem guides, operating devices, position indicators, wall brackets, floor boxes, anchors, and all appurtenances.
- B. Motors and electrical work incidental to installation and operation of sluice gates and slide gates shall be included herewith unless otherwise directed under other Contract Items.

1.3 QUALITY

- A. Equipment Rating: Certification Requirements
- B. References:
 - 1. ASTM American Society for Testing and Materials.
 - 2. AWWA C542-16 – Electric Motor Actuators for Valves and Slide Gates.
 - 3. AWWA C561-14 – Fabricated Stainless Steel Slide Gates.
 - 4. AWWA C562-14 – Fabricated Aluminum Slide Gates

1.4 PROTECTION

- A. All gates shall be shipped, stored, and installed in such a way as to avoid warping the frame and to maintain tolerances between seating faces.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.
- B. Sluice gates, slide gates, operators, and appurtenances shall be as shown on the Drawings, scheduled, as specified, or as ordered.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Slide gates shall be manufactured by:
 - 1. RW Gate Company
 - 2. Hydro Gate
 - 3. Whipps.
 - 4. Or Engineer-approved equal
- B. The naming of a particular manufacturer herein does not imply that manufacturer's standard equipment is suitable or approved for installation on this project. Slide gates shall meet all requirements of this specification without exception.

2.2 FRAMES

- A. Furnish flange back frames for all wall mounted gates, flat back frames for embedded gates and gates that will be mounted inside existing channels or spigot back as designated on the Drawings or in the Slide Gate Schedule. Gate seats, seals and frame shall be an integral unit.

2.3 GUIDES

- A. The guides shall be constructed from formed plate into a one-piece design. Wall mounted guides shall have a minimum weight of 13 lbs per foot. The portion of the wall mounted guide that the anchor penetrates shall have a minimum thickness of 1/2-inch.
- B. Embedded frames, frames to mount in existing channels and guide extensions shall have a minimum weight of 6.5 lbs per foot. The guides shall be sufficiently long to retain at least one half of the vertical dimension of the slide when fully open.
- C. Guides shall be faced with ultra-high molecular weight polymer (UHMWPE) with an intrinsic viscosity of not less than 14 and a low coefficient of friction. The UHMWPE seals shall be self-adjusting by means of a rubber compression cord contained between in the frame and seal and never in contact with the slide. The seal system shall be self-adjusting. Wedges and pressure pads are not acceptable.
- D. All seats and seals shall be mechanically fastened with 316 stainless steel attachment bolts and shall be field replaceable without the need to remove the frame from the wall or without the need to remove grout or concrete.

2.4 YOKES

- A. Furnish a yoke on self-contained gates that consists of two C-channels of sufficient dimensions to withstand loads developed during gate operation. Channels shall have a minimum depth of four (4) inches. Provide a stainless steel adaptor plate with a minimum thickness of 1/2-inch for mounting the operating mechanism.

2.5 SLIDE GATES (STEEL)

- A. Fabricated stainless steel slide gates shall comply with the latest release of ANSI/AWWA C561.
- B. Gate seat and angle frame shall be an integral unit of steel structural shapes, assembled by welding or bolting, to form the waterway opening. Side angles, filler bars, and cover bars shall form guides for the slide and holes shall be provided for mounting on anchor bolts.
- C. Slide gate shall be fabricated from plate having 1/4-inch minimum thickness and shall be reinforced with structural shapes sized to withstand the specified seating and unseating heads with a maximum deflection of 1/360 of the gate span. The slide shall be provided with a pocket for attaching the stem. This pocket shall be attached to the slide by welding and shall be capable of taking the full thrust developed during normal gate operation.
- D. Provide upward opening gates so designated with a solid EPDM or neoprene seal attached to the bottom of the slide or to the bottom cross member of the frame, flush with the invert. Attach seal with stainless steel attachment bolts and/or a stainless steel retainer, seal replaceable without disassembly of the gate.
- E. The gates, frames, stems and extensions shall be fabricated entirely of Type 316 stainless steel.

2.6 LIFT ASSEMBLIES

- A. Yoke mounted, handwheel-operated gearbox lift type with minimum 2:1 gear ratio and with single or double gears as required, and with thrust bearings above and below the flange on the bronze lifting nut. Bevel and pinion gears shall be steel with cut teeth, and spur gear shall be cast iron with cut teeth. Bearings for the gear and pinion shaft shall be bronze bushed. The lift shall operate on a 25-lb. pull on the crank. A clear butyrate plastic pipe stem cover shall be provided with Mylar open and close indication.
- B. The guides on self-contained gates shall extend above the operating floor. They shall be sufficiently strong so that additional reinforcing is not necessary. The yoke to support the operating benchstand will be formed by welding two C-channel structural members across the top of the guides.

- C. Where the head frame extends higher than 4 ft. above the operating floor, the gate operator shall include a bevel gear assembly.
- D. The Contractor shall field paint all manual lift housings with a suitable finish coat after installation of the gate assemblies.
- E. The stems shall have a minimum diameter of 1-1/2 inches and shall have machine rolled, full depth Acme threads

2.7 PAINTING AND FINISHING

- A. Shop Paint all iron and steel not stainless with one coat of rust inhibitive primer, Tnemec 37-77 Chem-Prime, Koppers 654 Primer, or equal, and one coat of machinery enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be as shown on the Drawings and in conformance with AWWA Standard C560, C561, C562 and C563 for slide gates.

3.2 TESTING

- A. After installation the Contractor shall test each gate/plate for satisfactory operation and watertightness against maximum operating pressure insofar as practicable.
- B. Leakage limits shall be as follows:
 - 1. Stop Plates: Leakage shall not exceed 0.1 gpm/ft. of wetted seal perimeter in seating head and unseating head conditions.
 - 2. Gates: Leakage shall not exceed 0.05 gpm/ft. of wetted seal perimeter in seating head and unseating head conditions.

3.3 OPERATION AND MAINTENANCE MANUALS

- A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions and a complete parts list and recommended spare parts list. The O & M manuals shall be in compliance with the General Requirements.

END OF SECTION 352016

SECTION 400513 – PROCESS PIPING

PART 1 - GENERAL

1.1 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section, including but not limited to Division 1, General Requirements.

1.2 DESCRIPTION OF WORK

- A. Exposed process piping.
- B. Buried process piping.
- C. Pipe supports, hangers and anchors.
- D. Couplings, sleeves and other miscellaneous piping accessories.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Piping and accessories for a specific system, such as chemical feed systems, are covered in other sections. Piping not included in other systems shall conform to this Section.
- B. Piping associated with plumbing, interior potable water systems and heating normally installed by a mechanical contractor.
- C. Division 31, Earthwork
- D. Division 32, Exterior Improvements
- E. Section 099700, Special Coatings
- F. Section 400523, Process Valves and Accessories

1.4 QUALITY ASSURANCE

- A. General: All materials shall be free from defects impairing strength and durability and be of the best quality for the purposes specified or shown on the Drawings. It shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected and be true to detail.
- B. Manufacturer's Qualifications
 - 1. Provide piping and appurtenances that are the standard product in regular production by Manufacturers whose products have proven reliable in similar service for at least five (5) years.
 - 2. Provide piping and appurtenances of the same type from a single manufacturer.

- C. The Contractor shall be responsible for making all field measurements prior to installation of his work. Any deviations in measurements between the field conditions and the Drawings shall be immediately reported to the Engineer.
- D. Testing
 - 1. Manufacturer's certified test results as defined for the type of pipe shall be stamped approved by the Contractor and forwarded to the Engineer as a Reference Submittal. No pipe shall be installed which does not meet the requirements of these Specifications.
 - 2. All pipe, joints, and fittings shall be pressure tested as required by this Specification for the type of pipe. The Contractor shall notify the Engineer or Owner, in writing, at least 48 hours prior to performing the tests.

1.5 SUBMITTALS

- A. Provide technical submittals in accordance with Section 013323, Submittal Procedures, demonstrating piping and accessories conform completely to the requirements of this Section.
- B. Product Data
 - 1. Catalog cut sheets and description of all items.
 - 2. Construction materials
 - 3. Standard diameters, wall thicknesses and other pertinent dimensions of all sizes of piping and accessories.
 - 4. Support and anchor details with manufacturer's maximum recommended loads.
 - 5. Design calculations indicating support spacing requirements for all size pipe.
- C. Shop Drawings
 - 1. Complete piping layout indicating type of pipe, diameter and location. Show dimensions from adjacent structure, equipment and other piping.
 - 2. Location of all pipe joints, sleeves, valves, and couplings.
 - 3. Location of all pipe supports and anchors.
 - 4. Details of pipe anchors, supports, couplings, and joints.
- D. Testing: Copies of all field test reports.

1.6 HANDLING, DELIVERY, AND STORAGE

- A. General
 - 1. Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations.
 - 2. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.
 - 3. Interiors of piping shall be completely free of dirt and foreign matter.

PART 2 - PRODUCTS

2.1 HANGERS, SUPPORTS, AND ATTACHMENTS

A. General

1. All support components shall conform to Manufacturer's Standardization Specifications SP-58 and SP-69. All pipe hangers and supports shall be in accordance with Ohio Basic Building Code Section 4101:2-51-11B.

B. Hangers and Supports

1. All piping shall be supported whether or not indicated on the Drawings and/or as specified herein. Piping shall be supported in such a manner to eliminate all undue stresses or strains to pumps or other equipment or piping to which it is connected.
2. Manufacturer
 - a. Crawford
 - b. Grinnel
 - c. Blaw-Knox
 - d. PHD Manufacturing, Columbiana, Ohio
 - e. Approved Equal
3. Hangers for pipe sizes 2 in. and smaller shall be adjustable swivel solid ring or split ring type and for sizes 2-1/2 in. and larger shall be adjustable wrought clevis type.
4. Copper tubing: Hangers for copper tubing shall be copper plated.
5. Provide all necessary supports, anchors, guides, and miscellaneous steel such as angles, channels, rods, hangers, wall brackets, riser clamps, beam clamps, concrete inserts, rollers, saddles, and other incidental devices.
6. Exposed piping shall be braced horizontally by angle irons anchored to the wall, or floor supported pedestals.
7. Concrete piers shall support base elbows and piping near floors, using a minimum of one pier per pipe length, as approved by the Engineer.

2.2 SLEEVES

- A. All sleeves in masonry construction shall be of galvanized steel pipe, all others shall be of minimum 20ga, uniformly formed, galvanized sheet metal.

B. Sealing of Sleeves and Penetrations

1. Non-shrink grout
 - a. Manufacturer/Product
 - 1) Master Builders Masterflow #713
2. Polyurethane sealer

- a. Product/Manufacturer
 - 1) Vulkem 116/Mameco International
- 3. Silicone sealer
 - a. Manufacturer/Product
 - 1) Dow-Corning #790
- 4. Silicone Foam
 - a. Manufacturer/Product
 - 1) Chase #CTC PR-855 Chase-Foam
 - 2) Dow Corning #3-6548 Silicone RTV Foam

2.3 PIPING

A. General

- 1. The outside of all piping, valves, and fittings shall bear the Manufacturer's standard marking for type, pressure, etc.
- 2. All carbon steel pipe shall be fabricated from open hearth or electrical furnaces. No Bessemer pipe shall be installed.
- 3. All pipe and fittings shall be equal to or better than the grade specified.
- 4. Whenever Specifications call for close bending or coiling, use Grade B pipe.
- 5. All piping material shall be new and free from defects and shall be subject to standard mill test before being shipped.
- 6. Pipe shall be labeled.
- 7. Fittings shall have the Manufacturer's name or trademark legibly raised or cut into each piece, and shall bear the Manufacturer's standard marking for type, pressure, etc.
- 8. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
- 9. No salvaged or used pipe shall be used without the written approval of the Engineer. Wherever such approval is given, the ends of the pipe shall be re-cut, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.

B. Pipe Materials: All piping in or under the building shall be Ductile Iron Pipe unless otherwise specified.

- 1. Ductile Iron Pipe
 - a. Pipe
 - 1) Standards
- 2. Flanged: ANSI/AWWA C115/A21.15
- 3. Non-flanged: ANSI/AWWA C151/A21.51

4. Thickness: Class 52 minimum
 - a. Lining: Cement-mortar lining, ANSI/AWWA C104/A21.4 for water service only; not to be used for air supply.
 - b. Coating
5. Buried pipe: 1 mil asphalt coating, AWWA C151
6. Exposed pipe to be painted: Factory prime coat compatible with finished coat system.
 - a. Joints
 - 1) As shown on the Drawings. If not designated, use flanged joints for exposed piping and push-on joints for buried piping.
 - 2) Flanged.
 - a) Ductile iron, ANSI A21.10
 - b) Bolt Circles and Bolt Holes: ANSI B 16.1.
 - c) Class: Class 125 except lines with a test pressure exceeding 125psi which shall have 250 flanges.
 - d) Gaskets: 1/8" rubber full faced.
 - e) Bolts and nuts
 - i. (Buried and exposed: Carbon steel per AWWA C115)
 - ii. (Submerged: Type 304 stainless steel)
 - b. Fittings
 - 1) Types: Flanged or mechanical, as indicated on Drawings.
 - 2) Flanged: ANSI/AWWA C110/A21.10
 - 3) Mechanical joint
 - a) 3"-16": Full body ANSI/AWWA C110/A21.10 or short body ANSI/AWWA C153/A21.53.
 - b) Larger than 16": Full body ANSI/AWWA C110/A21.10.
 - 4) Pressure rating: 250psi minimum.
 - 5) Coating and lining: Identical to connecting piping.
 - 6) Base tees and bends: Drill and furnish with anchor bolts. Machine when used as a pipe kicker.
7. Steel Pipe
 - a. Pipe
 - 1) ASTM A 53, Type A
 - 2) Wall thickness: Schedule 40 unless otherwise indicated.
 - b. Joints

- 1) Threaded or flanged.
- 2) ANSI B2.1
- 3) Joint preparation: Teflon tape for screwed joints

c. Coating

- 1) Buried pipe: Galvanized
- 2) Exposed pipe: Factory prime coat compatible with finish coating system.
- 3) Submerged pipe: Galvanized

d. Fittings for Schedule 40 pipe

- 1) Type: Malleable iron
- 2) Material: ASTM A47, Grade 32510
- 3) Dimension: ANSI B16.3
- 4) Threads: ANSI B2.1
- 5) Weight: 150 lb, standard

e. Fittings for Schedule 80 pipe

- 1) Type: Forged steel
- 2) Material: ASTM A 181, Class 60
- 3) Weight: 2,000 lb

8. Stainless Steel Pipe

a. Pipe

- 1) ASTM A333, AISI Type 304
- 2) Wall thickness: Schedule 10, unless otherwise indicated.

b. Joints

- 1) Threaded or flanged
- 2) ANSI B2.1
- 3) Joint preparation: Teflon tape

c. Fittings

- 1) Type: Stainless steel, ASTM A420, AISI Type 304
- 2) Threaded or flanged

d. Gaskets/Expansion Joints: Shall be suitable for high temperatures expected in the installation (180° F minimum)

9. Polyvinyl Chloride (PVC) Pipe and Fittings

- a. Pipe: Pipe shall be schedule 80, Type I, Grade I (Class 12454-B) conforming to ASTM D 1784 and D 1785.
- b. Nipples: Short nipples shall be the same as the PVC pipe.

- c. Fittings: Fittings shall be schedule 80 and shall conform to ASTM D 2464 for threaded fittings 6 inches and smaller and ASTM D 2467 for socket-type fittings 8 inches and smaller. For threaded fittings larger than 6 inches and for solvent welded fittings larger than 8 inches the fittings shall be schedule 80 per the manufacturer's standards. All fittings shall successfully pass the required pressure test.
- d. Flanges: PVC flanges shall be made of the same material as the pipe. Flanges shall match dimensions of ANSI B16.5, Class 150. Flanges shall be flat face.
- e. Unions: Unions shall have socket-type ends, EPDM o-rings, and shall be schedule 80. Material shall be Type 1, Grade I PVC, per ASTM D 1784.
- f. Joints
 - 1) Pipe and fitting joints shall be socket welded except where threaded and flanged joints are required to connect to unions, valves, and equipment.
 - 2) Screwed joints that are necessary to match up to threaded valves or fittings shall be made up with Teflon Tape only.
 - 3) Flanged joints shall be made with solvent welded PVC flanges.
- g. Solvent Cement
 - 1) IPS 717: 6" and greater
 - 2) IPS 719: Less than 6"
- h. Gaskets for flanges: PTFE/EPDM envelope gasket
- i. Bolts and Nuts for Flanges
 - 1) Bolts: Type 316 stainless steel conforming to ASTM A 193, Grade B8M
 - 2) Nuts: Silicon-bronze
 - 3) Provide a washer under each nut and under each bolthead. Washers shall be of the same material as the bolts.
 - 4) Lubricant shall be TRX-Synlube by Ramco, Anti-Seize by Ramco, Husk-It Husky Lube O'Seal, or equal.
- j. Threaded Ends: Taper pipe threads. All threaded female fittings shall be 316 stainless steel reinforced.
- k. Manufacturer
 - 1) Pipe: Harvel or equal
 - 2) Fittings: Spears or equal
 - 3) Piping Accessories

10. Wall and Floor Pipes

- a. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by Engineer.
- b. End Connections: As shown or approved by Engineer.

- c. Thickness: Same as specified for the piping connected to wall or floor pipe.
- d. Collars: Provide collars at mid-point of wall for anchorage and watertightness unless otherwise shown or approved by Engineer.
- e. Pipes ends shall be flush with wall face unless otherwise shown.
- f. Flanged ends and mechanical joint bells shall be drilled and tapped for studs. Provide studs of same material as connected piping except submerged and buried studs shall be of stainless steel.

11. Pipe Sleeves

- a. Ferrous and Plastic Pipe: Use standard weight galvanized steel pipe unless otherwise shown.

12. Cast Wall Sleeves

- a. Material: Cast iron furnished with integral wall collar.
- b. Dimensions: As required for mechanical joint or calked joint pipe to pass through sleeve. Length as required.

13. Mechanical Wall Seals

- a. Provide link type mechanical seals where indicated, suitable for 20 psi working pressure.
- b. Product/Manufacturer
 - 1) Link-Seal; Thunderline Corporation

14. Wall and Ceiling Plates

- 1) Bare pipes passing through walls and ceilings in finished rooms: Provide escutcheon plates of cast brass or cast iron nickel plated, clevis or split ring and hinged with set screws.
- 2) Insulated pipes passing through walls and ceilings in finished rooms: Provide plated escutcheon plates of 18 gage steel.

15. Bellows Expansion Joints and Flexible Couplings

- a. Manufacturer: Belmont Packing & Rubber Co.
- b. Uniformly machined bellows of high density TFE. Bellow designed to completely shield the flanges.
- c. Flanges: Ductile Iron, 125/150 lb drilling.
- d. Restriction Bolts: Provide to prevent bellows extension safe limit.
- e. Pressure Rating: 50 psi at 130°F.

16. Flanged Coupling Adapters

- a. Manufacturer
 - 1) Rockwell

2) Dresser Industries

b. Material

- 1) Body and Flange: Steel conforming to ASTM A282, Grade C.
- 2) Follower: Ductile iron, ASTM A-536 through 12" and steel as specified above for sizes over 12".
- 3) Bolts and Nuts: Alloy steel conforming to ANSI A 21.11. Cadmium plate as specified herein.
- 4) Gasket: Rockwell Grade 30, or equal.

c. Size and Type: As shown on the Drawings and to suit type, class, and size of pipe.

d. Flanges: AWWA Class D or Class E. Use Class E when test pressure specified is above 200 psi.

e. Painting

- 1) Interior Surface: Vinyl or coal tar epoxy coating.
- 2) Exterior Surface: One coat of primer compatible with finish paint system.

f. Tie Bolts, Lugs, and Clamps

- 1) Provide restraining system for various pipe lines as noted on Drawings or in the Schedules. See details shown on Drawings.
- 2) Steel Piping: Refer to AWWA Manual 11 for restraining system design.

17. Steel or Cast Compression Couplings

a. Manufacturer

- 1) Rockwell
- 2) Dresser Industries

b. Material

1) Rockwell Type 411, Dresser Style 138 Couplings:

- a) Sleeves: Steel for all sizes of ductile and steel pipe.
- b) Flanges: Malleable or steel

2) Rockwell Type 431, Dresser Style 53 Coupling

- a) Sleeves: Gray iron
- b) Flanges: Malleable or ductile iron

3) Bolts and Nuts: Alloy steel cadmium plates as specified herein. Number of bolts as recommended by the Manufacturer to suit the specified pressure ratings and conform to ANSI 21.11.

4) Gaskets: Rockwell, Grade 30, Dresser standard, or approved equal.

- c. Size and type: To suit size and type of pipe shown on the Drawings, and specified herein. Minimum sleeve length unless otherwise indicated on Schedule of Valves, Gates and Accessories.
- d. Tie Bolts, Lugs and Clamps
 - 1) Provide restraining system for various pipe lines as noted on Drawings or in the Schedules.
 - 2) Steel Pipe: Refer to AWWA Manual 11 for restraining system design.
- e. Painting: One exterior coat of primer compatible with finish paint system. Coat interior of steel couplings with Rockwell or Dresser standard coal tar epoxy.

18. Flange Rubber Expansion Joint

- a. General: Flanged rubber expansion joints shall allow axial compression or expansion, lateral movement, and axial deflection.
- b. Construction
 - 1) Lining: Leakproof layer of synthetic or natural rubber.
 - 2) Body: Fabric and rubber compounds with steel reinforcing.
 - 3) Cover: Synthetic or natural rubber with protective paint coating.
 - 4) Flanges: ANSI 125 lb. hole pattern. Provide 3/8" split steel retaining rings.
- c. Provide restraining rods and gusset plates between connecting flanges.
- d. Pressure rating: 125 psi
- e. Manufacturers: Red valve Redflex, PROCCO Series 200, Mercer.

19. Ferrous Fasteners: All bolts, nuts, and other ferrous fasteners used in the installation of piping systems shall be alloy steel conforming to ANSI 21.11 cadmium plated in accordance with Fed. Spec. QQ-P-41 6a, Class 3, Type II, except "T" bolts used with mechanical joint pipe.

- a. Expansion Joints for PVC and CPVC Pipe
 - 1) Type: Bellows type with restriction bolts
 - 2) Pressure Rating: 50 psi
 - 3) End Connections: Flanged
 - 4) Manufacturer: Belmont Packing & Rubber Co., or approved equal.
- b. Cutting-In-Sleeves
 - 1) Manufacturers: American Pipe, M&H Valve Company, Clow

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General

1. Piping shall be installed in a manner to permit easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.
2. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
3. Piping shall not be supported from other pipes, conduits, ducts or similar installations.
4. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
5. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the runouts of main piping, and shall be installed by the use of multiple elbows or other similar methods to minimize strain on the equipment connections.
6. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
7. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
8. Pipe size reductions shall be made with factory-fabricated eccentric reducers, concentric reducers, or reducing fittings and shall be installed not to cause pocketing or inhibit the flow of the material.
9. Install shut-off valves or cocks with unions on all connections to equipment and on each side of traps and control valves as required for ease of proper servicing and maintenance.
10. Unless otherwise indicated, the discharge from pressure-and temperature-relief valves and equipment drains shall be piped to the nearest floor or hub drain, installed with an approved air gap as required, and arranged for safe discharge.
11. No pipe shall penetrate any structural member without the written approval of the Engineer. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the Engineer.
12. Flanges and Gaskets
 - a. Where forged steel flanges are to be bolted to cast iron flanges, a smooth or flat-face forged steel flange with a full-face gasket shall be used.
 - b. All gaskets, other than teflon envelope or full-face, shall be of the flat ring type, with the outside diameter of the gasket extending to the edge of the bolts.
 - c. Gaskets for all joints shall have an inside diameter equal to the outside diameter of the pipes on which they are to be used to ensure that no portion of the gasket will project into the ports of valves, pipe, or fittings.
 - d. The dimensions of all gaskets shall conform to ANSI Standard B-16.21 for nonmetallic gaskets.
13. Provide flanged coupling adapters as necessary to accommodate ease of piping installation according to Contractor's layout plan.
14. Installation shall include all rough-in and final connections to equipment and services as provided in the Contract Documents, for the services and equipment to be functional.

- B. Cross Connections and Interconnections: No devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

3.2 PIPE EXPANSION CONTROL: INSTALLATION

A. General

1. Install expansion loops or joints as required, to limit strain and movement of the piping.
2. All loops shall be cold sprung when installed.
3. Install conforming manufactured guides for each loop and joint to maintain the proper pipe alignment and minimize undue stresses on the piping and joints.
4. All mechanical joints and guides shall be installed in accordance with the Manufacturer's recommendations.
5. Install conforming manufactured pipe anchors at the midpoint between loops and joints. Installation and design shall be subject to the approval of the Engineer.
6. Manufacturer shall be held responsible for the proper capacity of the joints, with a minimum 25% allowance beyond the anticipated expansion and contraction in the piping.

- B. Polyvinyl Chloride (PVC) Pipe: Provide expansion joints in straight piping runs over 50' and at least every 50'.

3.3 EXPOSED PIPING: INSTALLATION

A. General

1. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping and supports.
2. Painting of piping is specified in Section 09 90 00 of the Contract Documents.
3. Install straight runs true to line and elevation.
4. Install vertical pipe plumb in all directions.
5. Install piping parallel or perpendicular to building walls. Piping at angles and 45° runs across corners shall not be accepted unless specifically shown.

B. Joints

1. General

- a. Make joints in accordance with the pipe Manufacturer's recommendations and the requirements below.
- b. Cut piping accurate and square. Assemble without forcing or springing.
- c. Ream all pipes and tubing to full inside diameter after cutting. Remove sharp edges on end cuts.

- d. Remove all cuttings and foreign matter from the inside of pipes and tubing before installation.
- e. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.
- f. Thoroughly wire brush, wipe clean and dry all spigot mating surfaces immediately before pipe is installed.

2. Threaded Joints

- a. Use standard right-hand tapered full depth threads on steel piping.
- b. Apply before installation an approved joint compound to the male threads only.
- c. Leave three pipe threads maximum exposed at each connection.

3. Solder Joints

- a. Ream or file pipe to remove burrs.
- b. Clean and polish contact surfaces of joints
- c. Apply flux to both male and female ends.
- d. Insert end of tube full depth into fitting socket.
- e. Heat joint evenly.
- f. Form continuous solder bead around entire joint circumference.

- 4. Flanged Joints: Use hexagon head nuts and bolts. Assemble flanged joints with gaskets and gasket compounds in compliance with the applicable material specifications. Tighten flange bolts evenly.
- 5. Plastic Pipe Joints: Comply with Manufacturer's recommendations.
- 6. Welded Joints: Comply with all applicable requirements of Code for Pressure Piping, ANSI B13.1 Section 6, and AWWA C206 for steel pipe and fittings.

C. Unions

- 1. Install dielectric unions where dissimilar metals are connected except at bronze or brass valves installed in ferrous piping.
- 2. Provide a union downstream of each screwed end valve.
- 3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

D. Eccentric Reducers: Use eccentric reducers where shown and where air or water pockets would occur in mains because of reduction in pipe size.

E. Transitions between Types of Pipe: Provide all necessary adapters, specials and connector pieces when connecting different types and sizes of pipe or connecting pipe furnished by different Manufacturers.

F. Restraints, Supports and Thrust Blocks

- 1. Install restrained joints as shown, specified, recommended by Manufacturer or otherwise required.
- 2. Provide concrete and metal cradles, collars, kickers, and blocks as indicated.

G. Expansion Coupling

1. Install expansion couplings in tension to facilitate their removal.
2. Set stretcher bolts for maximum allowable elongation of expansion coupling as recommended by the Manufacturer.

H. Adjustment: Adjust all parts and components as required to provide correct operation.

I. Hangers, Supports and Attachments: Installation

1. General

- a. Attach supports to structural steel members, concrete or masonry, except as specifically noted on Drawings.
- b. No supports shall be attached to metal decking.
- c. No burning, cutting, welding to, or drilling of structural steel shall be permitted without approval of the Engineer or Owner.
- d. Supports shall not be located to obscure halls or passageways.
- e. Attachments to bar joists shall be as follows:
 - 1) The total number of attachments to an individual joist shall not exceed the length of that joist in feet divided by 6.
 - 2) The load transmitted to a joist by an attachment shall not exceed 75 lb. Trapezes to be supported shall be located in such a way that they can be supported by a sufficient number of joists and hangers to meet this requirement. Provide supplemental structural members to meet this requirement.
 - 3) Attachments to steel joists must be at panel point.
 - 4) Loads applied to the bottom chord must be applied concentrically to the joist.
 - 5) When the above requirements cannot be met for an item, the Contractor shall submit to the Engineer with the steel joist Shop Drawings, information as to what the item is, how much it weighs, methods of support, location of supports and magnitude of load on the support and any other information needed to properly attach the item to the steel joists.
- f. Unless shown on the Drawings, pipe hangers shall not be attached to purlins, truss vertical or diagonal members, sway bracing, tie rods or sag rods. Piping supports for 6" and larger pipe may not be tied to building steel without the addition of strengthening steel to compensate for the forces exerted by the piping, as approved by the Engineer.
- g. Lugs, plates and angle clips that are used as a part of an assembly for the support or guiding of pipe may be welded directly to the pipe.

2. Horizontal Piping

a. General

- 1) Adequately support piping system so there will not be any undue strains on joints, sagging, or swinging. Locate hangers near or at all change in piping direction and concentrated loads. Provide vertical adjustment type to maintain proper pitch and alignment and allow for unrestricted expansion and contraction of the piping.
 - 2) Fasten hangers to building steel or structural members wherever practicable.
 - 3) Provide angle irons anchored to wall to horizontally brace pipe where spans exceed 12' below elbows or tees.
 - 4) Support base elbows and piping near floors, using a minimum of one pier per pipe length.
- b. Polyvinyl Chloride (PVC) Pipe: Space pipe supports in strict accordance with pipe Manufacturer's recommendations.
3. Vertical Piping: Support piping on floors and stabilize with wall anchors.
 4. Structural Attachments
 - a. To Concrete - Use Anvil Intl. Fig 281, Wedge Type Concrete Insert, or Anvil Intl. Fig 282, Universal Concrete Insert, where corrosion is a factor. If inserts have been omitted, use expansion shield properly spaced to carry the load, or drill through the concrete and secure the rod to steel plates above. If support is required under hollow precast concrete, use toggle bolt with wings crosswise to the hole.
 - b. To Steel Beams - Where pipe size is 2" or less, use Anvil Intl. Fig 225. Where pipe size is more than 2" use Anvil Intl. Fig 218, Malleable Beam Clamp. If a bar joist type of construction exists, use Anvil Intl. Fig 94 or Fig 227, Top Beam Clamp.
 - c. Where welding to beam is permitted, use Anvil Intl. Welding Beam Attachment, Fig 66.
 - d. To wooden ceilings and beams, use Anvil Intl. Fig 153, Pipe Hanger Flange.
 5. Intermediate Attachments
 - a. Continuous threaded rod shall be used wherever possible.
 - b. No chain, wire or perforated strap shall be used.
 6. Pipe Attachments
 - a. When thermal expansion in excess of 1/2" axially is anticipated, use Anvil Intl. Fig 174, Adjustable Swivel Pipe Roll, or Anvil Intl. Fig 271, Pipe Roll Stand. Where pipe is insulated, use a pipe covering protection saddle Anvil Intl. Fig 160 through 166A in conjunction with the roll device.
 - b. For vertical pipe, use Anvil Intl. Fig 261.
 - c. Where it is necessary to support horizontal piping from walls, use Anvil Intl. Fig 194, 195, or 199, steel brackets with backing plates. Where pipe can be supported close to the wall, use a Unistrut type "J" conduit and pipe hanger.

- d. Piping installed with insulation shall be supported by Anvil Intl. Fig 260, Clevis Hangers, sized for and used with a Fig 167, Insulation Shield.
- e. For pipe supported from the floor, use Anvil Intl. Fig 258, Pipe Saddle Support, anchored to the floor.
- f. Where several pipes or conduits are to be installed together, trapeze hangers may be used. The horizontal support may be angle iron or Uni-Strut, with 1/2" minimum rods, to be reviewed by the Engineer.
- g. Double nuts shall be installed on all rod supports for pipe attachments.

J. Identification of Piping

- 1. Coordinate color-coding of both insulated and noninsulated piping with Section 09 90 00, Painting. Painting of piping is Work of Section 09 90 00, Painting.
- 2. Identify contents of piping and direction of flow in compliance with General Provisions.

3.4 BURIED PIPING: INSTALLATION

A. General

- 1. Minimum piping cover shall be 4' unless otherwise indicated.
- 2. Wherever pipes are installed below a slab resting on grade or whenever pipes pass below footings of any structure, concrete having a slump of not over 8 in. shall be placed 6 in. around the pipe for its full length beneath the slab or to the full width of the footing.

B. Bedding Pipe

- 1. Trenches shall be excavated to lines and grades indicated. Trenches shall be of sufficient width to permit proper making of joints and, where necessary, placing of sheeting and bracing, but, within these limits, shall be as narrow as possible. Sheeting and bracing shall be used at the expense of the Contractor where necessary, to prevent caving in of trenches.
- 2. All sheeting and bracing shall be removed as trenches are backfilled. Where pipe would be laid in organic material, same shall be removed to minimum of 3 ft below bottom of pipe and replaced with approved compacted fill material.
- 3. Bed pipe evenly over the lower third of its circumference unless otherwise indicated.
- 4. Provide a uniform support for the entire length of pipe, except for bells and other joints for which a recess of sufficient depth to relieve joints of load and to allow space for making and inspecting joints around entire circumference shall be provided.
- 5. Existing material unsuitable for bedding shall be replaced with granular bedding material.
- 6. Backfill shall not be placed above the top of the pipe until elevations, gradient, alignment, and pipe joints have been checked, inspected, and approved by the Contractor. All pipe shall be held in place by cable and winch or other suitable method during backfill operations so that there will be no movement in the pipe joints.

7. Carefully deposit backfill material to a depth of 12" above top of pipe by methods which shall prevent damage or movement of the pipe. Thoroughly compact bedding and backfill materials with hand held pneumatic compactors.

C. Laying Pipe

1. Comply with Manufacturer's instructions and with AWWA C600 where applicable.
2. Install all piping true to line and grade shown unless otherwise indicated.
3. Slope piping uniformly between elevations shown.
4. Ensure that water level in trench is at least 6" below bottom of pipe.
 - a. Lay no pipe in water.
 - b. Maintain dry trench until jointing and backfilling are complete.
5. Lay pipe beginning at lowest point and proceed toward the higher elevations. Point spigot ends in the direction of flow.
6. Lay all pipes with ends abutting.
7. Excavate around joints in bedding and lay pipe so that only the barrel bears directly on the trench bottom.
8. Joint deflections shall not exceed Manufacturer's recommendation.
9. Take every precaution to ensure that no foreign material enters the piping prior to and during installation.
10. Carefully examine all pipe and fittings for cracks, damage or other defects while suspended above the trench just before installation. Remove defective materials from site.
11. Remove all dirt, gravel, sand, debris or other foreign material from the pipe interior before the pipe is moved into the trench.
12. Wire brush bell and spigot mating surfaces and wipe clean and dry immediately before pipe is laid.
13. Close the open ends of piping with a watertight plug whenever laying is not in active progress.
14. Field cut pipe, where required, using specially designed machine.
 - a. Make cuts carefully to avoid damage to pipe or lining and to leave smooth right angle end.
 - b. Taper cut ends and file sharp edges smooth.
 - c. Avoid flame cutting.
15. Blocking under piping shall be permitted only when acceptable to the Engineer for special conditions. Comply with AWWA C600 requirements where permitted.
16. Touch up protective coatings satisfactorily prior to backfilling.

D. Jointing Pipe

1. Completely clean all jointing surfaces and adjacent areas just before making joint.
2. Lubricate and adjust gaskets and "O"-rings as recommended by Manufacturer.
3. Check each gasket carefully for proper position around full circumference of the joint after "O"-rings are compressed and before pipe is brought fully home.
4. Comply with AWWA C111 and all applicable Manufacturer's recommendations pertaining to jointing pipe.

5. Mechanical Joints

- a. Center and push the plain end into the bell.
- b. Firmly press the gasket evenly into the bell.
- c. Slide the gland to the bell for bolting.
- d. Oil bolt threads.
- e. Tighten all bolts alternately 180° opposite to each other to seat the gasket evenly. The maximum torque shall be as follows:

Bolt Size (inches)	Applied Torque (ft-lb)
5/8	50
3/4	80
1	90
1-1/4	110

- f. Apply heavy bituminous coating to all bolts and nuts.

6. Flanged Joints

- a. Use hexagon head nuts and bolts. Bolts shall fully project through the end of the nut to 1/4" maximum.
- b. Use 1/8" thick full-face gaskets, unless otherwise specified.
- c. Comply with Manufacturer's rating and instructions for specified service.
- d. Clean and lubricate bolt threads and gasket faces.

E. Restraints, Supports and Thrust Blocks

1. Install restrained joints as shown, specified, and recommended by the Manufacturer or otherwise required.
2. Provide concrete and metal cradles, collars, and blocks as shown.

F. Transitions between Types of Pipe

1. Provide all necessary adapters, specials and connector pieces when connecting different types and sizes of pipe or connecting pipe furnished by different Manufacturers.
2. Encase all such connecting joints with concrete at least 6" thick all around and not less than 1 foot each side of connecting joint.

G. Closures

1. Provide all closure pieces shown or required to complete the Work.
2. Locate closures in straight runs of pipe.

3.5 SLEEVES: INSTALLATION

- A. Provide and accurately locate all sleeves required under this Section. Set sleeves true to line, grade and position, plumb or level, and maintain as such during the work under other Divisions.

- B. Sufficient advance notice shall be supplied to the proper trade to enable the installation to progress.
- C. Whenever improper location or insufficient notice is provided for the installation of the sleeves, such work shall be done as Work of this Section, with no change in the Contract Sum or the Date of Substantial Completion.
- D. Sleeves shall not penetrate any structural member except as shown on the Drawings.
- E. Provide 8" clear space between sleeves unless otherwise indicated on the Drawings.
- F. Sleeves shall be of the full thickness, with the exposed ends flush and smooth, with the structure in which they are installed.
- G. Wherever water might get into the sleeve, the sleeves shall extend 1" above the finished surface and be made watertight. The exposed end shall be smooth and neatly finished.
- H. On all piping passing through a sleeve, the piping insulation shall be continuous through the sleeve. The sleeve shall be sized to allow a 1" annular space between the sleeve and the bare pipe or insulation.
- I. Sealing of Sleeves and Penetrations
 - 1. Where sleeves are embedded through cast-in-place concrete walls or slabs on or below grade, the joints between the concrete and the sleeve shall be sealed with a polyurethane sealer.
 - 2. Where sleeves pass through boxed out or cored openings in concrete walls or floor slabs on or below grade, a bonding agent shall be applied to the concrete surface and a non-shrink grout shall be installed between the concrete and the sleeves. After the grout has cured, the joints between the grout and the sleeves on both sides of the wall or floor shall be sealed with a polyurethane sealer.
 - 3. Where sleeves pass through exterior building walls above grade, the joints between the wall and sleeve on both sides of the wall shall be sealed with silicone sealer or the opening shall be sealed with a silicone foam.
- J. The 1" annular space around pipes passing through sleeves shall be filled with silicone foam having a minimum service temperature rating at least 15°F (8.3°C) higher than the temperature of the pipe service passing through it.

3.6 WORK AFFECTING EXISTING PIPING

- A. Location of Existing Piping
 - 1. Locations of existing piping shown shall be considered approximate.
 - 2. Contractor is responsible for determining exact location of existing piping to which he must make connections, may disturb during earth moving operations, or may affect in any way by his work.
- B. Removing Existing Pipelines from Service

1. Pipelines shall not be removed from service unless approved by the Engineer or Owner.
2. Notify the Engineer or Owner at least 48 hrs. prior to taking pipeline out of service.

C. Work on Existing Pipelines

1. Cut piping as shown or required using machines designed specifically for this work.
2. Install temporary plugs to keep out all mud, dirt, water and debris.
3. Provide all necessary adapters, fittings, pipe and appurtenances.
4. Comply with all applicable specification requirements for installing new pipe, including connections or modifications and for cleaning testing and disinfecting portions of existing piping modified or to which connections are made.

3.7 TESTING

A. General

1. All pipelines shall be tested to prove tightness of the final assembly. The Engineer shall be given 24 hours-notice before each test.
2. All tests required by governing authorities shall be satisfactorily made.
3. Provide all necessary testing apparatus, including gages, pumps, hoses, and fittings.
4. Repair and retest pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate.
5. Test pressures specified apply at the lowest elevation of the pipeline section being tested unless otherwise noted.
6. The Contractor is responsible for all testing and shall pay all costs incurred during the specified testing.

B. Hydrostatic Pressure Testing

1. General
 - a. Conduct hydrostatic pressure testing on all process piping in accordance with AWWA C600.
 - b. Slowly fill section to be tested with water and expel all air. Install corporation cocks as necessary to remove air.
 - c. Apply test pressure for two hours.
2. Exposed Piping
 - a. Allow any concrete which may be affected by the testing to reach design strength before testing.
 - b. Ensure that all supports and restraint protection are securely in place.
3. Buried Piping

- a. Place and compact backfill to at least the pipe centerline before testing, unless otherwise required or acceptable to the Engineer. Backfill and compact around all blocking before testing and as required to assure restraint by harnessed joints.
 - b. Allow concrete for blocking to reach design strength before testing.
- 4. Test Pressure
 - a. Piping connected to pump suction and discharge: 150% of specified maximum operating head of pump.
 - b. Gravity flow ductile iron pipe: 150% of maximum static water head of pipe section being tested.
 - c. Liquid chemical feed piping: 100 psi
- C. Exposed Piping: Additional Testing
 - 1. Gaseous Chemical Pipe Testing
 - a. Completely purge piping with dry compressed nitrogen or air.
 - b. Fill pipeline with dry air or nitrogen and pressurize as follows:
 - 1) Chlorine Gas Vacuum: 150 psi
 - 2) Carbon dioxide: 300 psi
 - c. Test all joints with soapy water solution. No leakage shall be evident.

3.8 CLEANING AND DISINFECTION

A. General

- 1. All piping systems shall be cleaned and flushed out prior to operation. If it is necessary to place the system in operation by sections, then the cleaning shall be done by sections. Notify Owner prior to start of Work.
- 2. Inspect inside of piping 24" diameter and larger and remove all debris, dirt and foreign matter.
- 3. All piping, including equipment installed in connection with the piping, conveying liquids shall be filled and flushed several times to eliminate all debris and contaminants.
- 4. Where pumps are installed, install temporary strainers ahead of pumps and circulate the medium through several cycles. The system shall be flushed out and the temporary strainers removed. Strainers shall have a free area of at least 3 times the cross sectional area of the attached pipe.
- 5. Prior to turning over the Work, this Contractor shall remove and clean all strainers, traps, and dirt pockets.

B. Disinfection

1. Standard: AWWA C651 unless otherwise acceptable to the Engineer.
2. Disinfect all potable water piping.
3. Flush piping with water at 2-1/2 feet per sec minimum velocity prior to disinfection.
4. Water for flushing, testing and chlorination will be furnished by Owner at no cost to Contractor.
5. Chlorine shall be supplied by Contractor.
6. All other labor, material and equipment including chlorination taps and blow-off taps shall be furnished and paid for by the Contractor.
7. Chlorine Concentration
 - a. Maintain chlorine concentration between 50 and 100 parts per million for water entering the pipe.
 - b. 25 parts per million minimum residual concentration shall remain after 24-hour retention period.
 - c. Repeat the operation as necessary to provide complete disinfection.

END OF SECTION 400513

SECTION 400523 - PROCESS VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Extent of each type of size of valve required is indicated on drawings and/or schedule.
- B. All valves used for a particular service are to be of the same manufacturer, make and style for each valve type.
- C. Each valve unit shall be of the proper size and type to suit the intended service with appropriate; body style, operator, joint accessories, coatings, guides, supports, pertinent accessories to be complete, in placed, tested and ready for service in conformance with project conditions.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections.
- B. Product Data: Provide manufacturer's illustrated catalog data depicting general construction, materials list, coatings and necessary appurtenances in sufficient detail to verify product compliance.
- C. Shop Drawings: Provide manufacturer's drawings showing; principal dimensions, operator detail and arrangements, project schedule tag reference or location of intended usage as required to suit project conditions.

1.4 QUALITY ASSURANCE

- A. Each valve shall be subjected to operation and hydrostatic tests at the manufacturer's plant as specified within applicable AWWA Standards.
- B. All coated surfaces shall receive manufacturer's production and holiday testing as specified in applicable AWWA Standards.

1.5 DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.
2. Protect valve ends against damage and entry of dirt, etc. by use of appropriate end protectors.
3. Set valves in best position for handling. Set gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.

B. Storage: Use the following precautions during storage:

1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Handling: Use a sling to handle valve whose size requires handling by crane or lift. Rig valves to avoid damage to exposed or internal valve parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Valves bodies shall be of either gray or ductile cast iron and shall have the name, monogram, or initials of the manufacturer cast thereon.
- B. Valves shall have nonrising stems, open by turning left or counter-clockwise and be provided with either a 2-inch square nut for buried valves or handwheel for exposed valves unless otherwise noted. The direction of opening shall be indicated by an arrow cast on the body and/or the actuator.
- C. All body bolts and nuts shall be bronze or stainless steel for buried, submerged or nonprotected applications and cadmium plated for exposed or interior applications that will receive protective finish coatings.

2.2 GATE OR TAPPING VALVES

- A. The valves, described in this section shall be resilient seated gate valves manufactured to meet or exceed AWWA C509. Valves shall be of compression type seal design, providing bubble tight shut-off with bi-directional seating ability for pressures up to 200 psi.
- B. The valve shall have a smooth, unobstructed waterway free from any sedimentation pockets. Valve shall provide a 100% port of nominal pipe size when fully open. Tapping valve port shall be sized to permit a full pipe port tap.
- C. Body style shall be mechanical joint type for buried service, flange joint type for exposed service and when required, to include special end connections for tapping requirements or otherwise if indicated on the contract drawings.
- D. Stuffing boxes shall be O-ring seal type with two (2) rings located in steam above thrust collar.
- E. Thrust bearings shall be of the low friction torque reduction type, located both above and below the steam collar.
- F. Valves shall be as manufactured by; American-Darling, Clow, M & H, Mueller, U.S. Pipe or an approved equivalent.

2.3 BUTTERFLY VALVES - WATER

- A. Butterfly valves shall comply with the latest revision of AWWA Specification C504, Class 150B. Valve discs shall be ductile iron, one (1) piece cast design for constant drip tight closure with flow in either direction for pressure up to 150 psi.
- B. Body style shall be full bodied, mechanical joint for buried service and flange joint type for exposed service unless otherwise indicated on the contract drawings.
- C. Wafer or lug body styles, when called for, shall have body applied seats that totally encapsulate the inside surface of the valve and also serve as the flange gaskets.
- D. All valve seat mating surfaces shall be against a 304 stainless steel or nickel-chromium disc edge surface for body applied seats or a 304 stainless steel surface with an O-ring seal against the body for disc applied seats as applied by means of manufacturers specified herein.
- E. Full body style valve seats shall be of Buna-N (Nitrile) rubber applied to either the body or the disc:
 - 1. Body applied seats shall be retained by a bonding process meeting ASTM-D-429, Test Method "B" or may be mechanically retained.

2. Disc applied seats to be mechanically secured by a 304 stainless steel retention ring and fasteners to allow for field adjustability or replacement.
- F. Shafts shall be 316 or 304 stainless steel construction. Shaft bearings shall be self-lubricated sleeve type. Shaft seals may be of V-type packing or standard O-ring seals allowing replacement without removing the valve shaft.
- G. Valves shall be as manufactured by; American-Darling, Mueller, Pratt, DeZurik, Keystone or an approved equivalent.

2.4 BUTTERFLY VALVES - AIR

- A. Valves utilized shall be specifically designed for air service and 25 psi air pressure.
- B. Butterfly valves shall meet the intent of the latest AWWA Specification C504, Class 25. These valves shall be a fully lugged wafer type or a flanged type design as indicated on the contract drawings; with cast iron body, ASTM A126, Class B.
- C. Disc to be ductile iron, ASTM A536, Grade 65-45-12 with electroless nickel plating or solid welded on nickel disc edge.
- D. Elastomer seats shall be in the body. Seat on disc edge is not acceptable in air systems. Seats shall be of EPDM, and be field replaceable without special tools. Elastomer thickness, not inclusive of backing rings or stiffeners, shall be a minimum of 3/8-inch for valves 6 inches and smaller; and 1/2-inch for valves 8 inches and larger.
- E. Shafts shall be of 304 or 316 stainless steel construction. Shaft seals shall be adjustable chevron packing or O-ring.
- F. Discharge butterfly valves shall have locking lever operators.
- G. The valves shall be the product of Keystone, DeZurik or an approved equivalent.

2.5 CHECK VALVES - WATER

- A. Swing Check: Valves shall be quiet closing and constructed for a minimum of 150 pounds working pressure. They shall be iron body, bronze seats, with outside lever and adjustable weights and have hinge pins of stainless steel or bronze. Valves shall be a product of American-Darling, Clow, Empire-GA, Mueller, U.S. Pipe or an approved equivalent.
- B. Air Cushioned Swing Check: Valves shall be GA Industries Model 250-D cushioned swing check valves with outside lever and weight; APCO; or an approved equivalent. Cushioned check valves shall be installed in the locations noted.
- C. Valves shall be in full compliance with the latest revision of AWWA Specification C508.

2.6 CHECK VALVES - AIR

- A. The body of wafer type construction shall be designed for 25 psi air pressure.
- B. Valves shall have a EPDM sealing member suitable for continuous duty operation.
- C. Bodies shall be cast iron, ASTM A126, Class B with aluminum bronze plates. The valve shall be drilled to match standard ANSI 125 flanges.
- D. Valves shall be Mission "Duo-Check II"; Techno Check Valve; an approved equivalent.

2.7 KNIFE GATE VALVES

- A. Knife gate valves shall be wafer style with tapped bolt holes, one (1) piece body design, and suitable for 0 to 150 psig drip-tight shut-off service. Valves over 20 inches in diameter shall be suitable for 50 psig rating.
- B. Valve, bodies, blade, stem, and all other wetted parts shall be 304 stainless steel. The gate shall have a rounded bottom with beveled knife edge and all sides of gate should be finish ground.
- C. Valves shall have handwheel with rising stem and rated for service pressures. Valves over 20 inches in diameter shall be bevel gear operated.
- D. Flanges shall be drilled to ANSI B 16.1, CL 125, 150 psi standard.
- E. Valve packing shall be suitable material, multiple V-ring, compression type with a definite packing gland coated with plastic or epoxy to prevent corrosion.
- F. The yoke sleeve shall be acid resisting bronze.
- G. Provide neoprene elastomer seat ring.
- H. Valves shall be the product of DeZurik Series L825, Ecolaine Series 7L, Red Valve Series G or an approved equivalent.

2.8 PLUG VALVES

- A. Valves shall be the nonlubricated, eccentric type with resilient, soft faced Buna-N rubber plugs providing bi-directional dead-tight shut-off to the full valve rating. Valve pressure ratings shall be 175 psi through 12 inches and 150 psi for valves over 12 inches.
- B. Bodies of valves shall be furnished with a welded overlay seat of not less than 90% pure nickel. Seat area shall be completely covered with raised surface weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

- C. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat shall be externally adjustable in the field with valve in line under pressure.
- D. Valve bearings shall be sleeve type, oil impregnated, permanently lubricated, stainless steel. Nonmetallic bearings shall not be acceptable.
- E. Shaft seals may be of the multiple V-ring or O-ring type conforming with ASTM C504 and shall be externally adjustable and replaceable without removing the valve while under pressure.
- F. Valves shall be as manufactured by; DeZurik, Keystone, Milliken or an approved equivalent.

2.9 PRESSURE RELIEF VALVES - AIR

- A. The pressure relief valves shall be compatible with the operating conditions of the blowers as defined elsewhere in these specifications. Each of the blowers shall be furnished with a weighted pressure relief valve on the discharge as shown on the drawings.
- B. The weight loaded pressure relief valve shall be cast iron body with cast iron weights. The cast iron weights shall be easily added or subtracted so that an adjustment can be made to accommodate the blower's pressure capabilities.
- C. The weighted pressure relief valves shall be as manufactured by Fuller Company; Roots Type PW; or an approved equivalent.

2.10 PRESSURE RELIEF VALVES - WATER; TANK TYPE

- A. Valves to be of floor and wall type as required to suit project conditions. All such valves are to be of same manufacturer throughout project and installed per published recommendations of such.
- B. Valves shall be of flanged body style and be complete with body, or wall, pipe in length of concrete thickness being placed, removable strainer and soft composition rubber seats on both the body and cover.
- C. Floor types have integral locking lugs to retain cover, but allow for removable if necessary.
- D. Wall types shall be hinged with bronze pin and may permit use of an independent wall casting if strainer is mounted within the valve unit.

- E. Valves shall be as manufactured by; American-Darling, Clow, Trumbull Industries or an approved equivalent.

2.11 MUD VALVES

- A. Valves shall be of the rising stem type unless otherwise noted.
- B. The valve body shall be flanged and drilled to ANSI B 16.1, CL 125, 150 psi standard.
- C. The stem, stem nut, disc ring, and seat ring shall be bronze.
- D. Extension stems, operator, stem supports, floor box, etc. shall be provided as required by specifications, Valve Schedule and/or shown on the drawings.
- E. Valve shall be as manufactured by; Clow, M & H, Troy Valve or an approved equivalent.

2.12 TELESCOPING VALVES

- A. Valves shall be capable of giving an infinitely variable discharge rate to suit travel range as indicated on the drawings.
- B. Valves shall be of the rising stem type, unless otherwise noted.
- C. General Contractor shall provide normal bolted, cast iron flange at elevation shown on the drawing and shall be responsible to provide sufficient straight pipe below the valve to allow for full travel of the tube inside.
- D. Each valve shall consist of an offset cast iron floor stand with suitable stem guide, cut tooth pinion bar rack assembly, spur gear with ductile iron locking panel, clear plastic stem cover with cap and travel scale indicator. Pinion shaft is operated by a 12-inch diameter offset handwheel with a rotating crank handle, or an 18-inch diameter top mounted handwheel with anti-rotation plate as required by valve schedule and/or plan illustration.
- E. The decant tube is to be of PVC pipe, smooth, stiff, concentric, connected on upper end with stainless steel bail and threaded adjustable rod connected to the bar rack assembly.
- F. Special flange having a neoprene O-ring insert and a flange transition seal gasket shall be provided by the equipment manufacturer to bolt to pipe flange by Contractor. Foundation bolts for operating stand will be stainless steel furnished with the equipment.
- G. Valves shall be as manufactured by; FMC Corporation, Waterman Industries or an approved equivalent.

2.13 SURGE RELIEF VALVE

- A. Valves shall open rapidly when system pressure exceeds the intensity for which the pilot is set and close upon pressure subsidence below pilot setting. Provision shall be incorporated to regulate the closing speed of the valve. Initial relief pressure to be factory set.
- B. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is of a greater area than the underside of the piston.
- C. The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling.
- D. The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. The valve may be furnished either in a globe or angle design to suit project conditions.
- E. The valve interior trim shall be bronze conforming to ASTM B62.
- F. All controls and piping shall be noncorrosive construction materials.
- G. A visual valve position indicator shall be provided for observing the valve piston position at any time.
- H. Valves shall be as manufactured by GA Industries Figure 6600-DL or an approved equivalent.

2.14 FLAP GATES/TIDE GATES

- A. Unless otherwise indicated, flap gates/tide gates shall be as follows:
 - 1. Flap valves shall have a flanged cast iron frame and flap with bronze seats having heavy duty cast iron double hinge arms with stainless steel hinge pins.
 - 2. All gates shall be fully automatic, operating solely by differences in pressure on both sides of the valve. Each valve shall be adjustable so as to provide the optimum opening and yet close providing a virtually watertight seal when no seating head is present.
 - 3. The flap gate shall be secured to a flanged wall casting or thimble connection unless otherwise indicated. Wall thimbles, when needed, shall be a one-piece design supplied by the flap gate manufacturer.

4. Valves shall be as manufactured by Hydro-Gate, Rodney Hunt, Troy Valve or an approved equivalent.

2.15 DIGESTER GAS VALVES

- A. The gas service valves for the digesters shall be nonlubricated eccentric plug valves with resilient plug seal which shall be Type RS Buna-N and shall be UL listed for gas service.
- B. The plug valves shall provide complete shut-off of the flow stream and the O-ring seal shall be completely gas-tight, permitting no leakage whatsoever of the sewage gas to the atmosphere.
- C. Corrosion-resistant bushings of the permanently lubricated type shall be provided in the upper and lower plug journals to support the rotating element true unions. Bearings shall be stainless steel or bronze suitable for sewage gas service. Tape sprayed, or roll-on bushing or sleeves are not acceptable.
- D. Valves shall be as manufactured by DeZurik Series 425 or an approved equivalent.

2.16 OPERATORS

- A. All valves 6 inches and larger, and all buried, submerged, or chain operated valves shall be gear operated. Gears for valve operation shall be sized for the working pressure and installed in such a manner that the stuffing box will be accessible for packing.
- B. Manual Operation
 1. Valves shall be equipped with nut, handwheel, crank, chain, gears, floor stand, and other appurtenances as required for manual operation as specified or scheduled.
 2. Operation shall be designed so that the effort required to operate the handwheel, lever, or chain shall not exceed 25 lbs. applied at the extremity of the wheel or lever.
 3. Handwheels on valves 4 in. and larger shall not be less than 12 in. in diameter.
 4. Chainwheels shall be provided when installed centerline of valve is over 5 ft.-6 in. above the floor. Chains shall be cadmium plated and loop 3 ft.-6 in. from the floor. Orient chainwheel and provide intermediate pulley mounting, if necessary, to permit unobstructed chain operation.
 5. Wrench nuts shall be cast iron or bronze, 1-15/16 in. at top, 2 in. square at base and 1-3/4 in. high with a flanged base.

- a. Provide one (1) tee wrench for each valve type used and of each significant length differential required. All wrenches supplied shall be a length so that the bar handle extends approximately 3 feet above finished grade in addition to the required bury depth length(s).

C. Hydraulic Operation

1. Valves for hydraulic operation shall be equipped with cylinders in accordance with AWWA C540, mounted on the valve bonnet. The size of the cylinder shall be determined by the valve manufacturer to be adequate for specified pressure and operating conditions in each instance where a hydraulically operated valve is specified in the definitive specifications of this section. Unless otherwise specified, cylinders above 12 inches in size, or where the cylinder pressure exceeds 100 lbs., shall be cast iron bronze-lined type.

D. Electric valve operations

1. The operator shall be the helical and worm gear type driven by an electric motor. All power gearing shall be grease lubricated. The actuator shall be in conformance with AWWA C540. The valve manufacturer shall furnish the value of the maximum operating torque required to operate the valve as defined in the Appendix to AWWA C540. The operator manufacturer shall furnish evidence that the operator is designed to equal or exceed the torque requirements.
2. Unless otherwise noted, the operator shall be geared to operate the valve from the fully open position to the fully closed position or vice-versa in approximately 60 seconds. It shall be possible to change this cycle time by substituting suitable gear trains. The operator shall be equipped with a declutchable handwheel for manual operation. The operator shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
3. Suitable reduction gearing shall be provided off the main shaft of the gearing, turning approximately 270 degrees while the valve performs full travel. The reduction gearing shall be equipped with the following position indicating devices for each operator:
 - a. A mechanical position indicator dial;
 - b. The output signal shall be 4-20 ma; a standard potentiometer, 1000 ohms with linearity of +/- 3% for indication in the remote controller;

4. Each operator shall be equipped with adjustable torque switches for overload protection in both opening and closing directions with torque switch bypass for unseating.
5. Each operator shall be equipped with four adjustable train gear limit switches. Each limit switch shall include a switch and counter gear. The setting accuracy shall be less than 1/10 turn of the operator output shaft. Two (2) gear limit switches are for remote indication of end positions.
6. Each motor shall be 480 volts, 60 Hz, three phase, induction type as recommended by the operator manufacturer.
7. Three (3) thermostats in series placed in the winding shall provide the motor with thermal protection. They shall interrupt the control circuit as soon as the temperature goes beyond the permissible winding temperature.
8. Each operator shall be equipped with a reversing magnetic starter. The starter shall be capable of receiving contact closures from remote sources to actuate the operator in either direction. Control voltage shall be 120 volts supplied by a transformer included in the control enclosure. Each operator shall include a local OPEN-STOP-CLOSE control, push button station, and a pad lockable LOCAL-OFF-REMOTE selector switch.
9. All electrical components shall be integral with the operator, housed in a watertight NEMA 4X enclosure and completely wired.
10. A circuit-breaker disconnect shall be provided with the operator.
11. Easily identifiable terminal blocks shall be provided for all external power, control, and signal connections.
12. Operators, located outdoors, shall include thermostats and space heaters in the motor and control compartments.
13. The operator shall be as manufactured by Rotork, Limitorque, EIM, or equal.

2.17 PROTECTIVE COATINGS

- A. All iron parts of valve assemblies shall be painted before leaving the shop.
- B. All exterior and internal waterway ferrous surfaces of each valve, except finished or bearing surfaces shall be shop painted with a liquid or powder epoxy coating of approximately 10 mils dry film thickness conforming to AWWA C-550.

2.18 EXTENSION STEMS AND STEM GUIDES

- A. When required by drawings, schedule or project details, provide an extension stem made of cold-rolled steel material and the same size as the stem of the valve it operates. If the extension is more than 8 ft. long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at a maximum spacing of 8 ft.
- B. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bronze bushed where it contacts the extension stem. Stem guides shall be as manufactured by the Eddy Valve Co., Rodney Hunt, or equal. Secure stem guides to walls with stainless steel bolts. In the event of off-set or misalignment, provide off-set extension rod with universal end fittings at valve actuator and stem drop connection.
- C. Extension stem shall have connecting socket for 2-inch square nut and pinsocket to lock on valve operating nut.

2.19 VALVE BOXES

- A. Valve boxes shall be cast iron, 5-1/4" shaft, three-piece screw type, adjustable boxes. The top section to have a drop lid of which to be marked for service which it is used cast thereon. Cover and boxes shall be round pattern.
- B. Provide proper base size and shape to straddle the valve bonnet without touching or being supported by the valve mechanism. Use No. 6 base size for 6-inch and 8-inch gate valves or typical butterfly valve operators, No. 160 oval base size for 12-inch and larger gate valves or other size necessary to suit a particular valve manufacturer's requirements.
- C. Extension sections shall be provided where the depth of trench is such that they are needed to bring the top of the box to finished grade. The valve box shall be installed so that it is perfectly vertical and centered on the valve operating nut.

2.20 FLOOR BOXES AND STANDS

- A. Each valve operator projecting through a floor shall be equipped with a floor box or floor stand and extension stem.
- B. Floor boxes for access to operating nuts of valves, sluice or slide gates shall be cast iron cover and body with bronze or brass bushings. Casting length to equal the thickness of the concrete slab in as much as possible. Floor boxes shall be as manufactured by Clow, Trumbull Industries or an approved equivalent.
- C. Floor stands shall be made of cast iron and shall extend to a level where handwheel or other operator is easily operated. Stands shall be fitted with bronze bushings to maintain proper stem alignment, brass or stainless steel nameplates shall be provided to identify related valve manufacturer, valve type and size or in the case of stand being of valve manufacturer, cast in name would suffice. Provide plastic stem covers with open-close

scale for all rising stem applications. Stands shall be anchored to the concrete slab with stainless steel bolts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Valves shall be carefully handled and placed so as not to permit any damage to the interior coatings, disc or seat. Internal type lifting devices shall not be permitted. Do not use handwheels or stems as lifting or rigging points.
- B. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of the specifications.
- C. Stem guides shall be accurately aligned.
- D. If the valve box is tipped or otherwise not centered on the valve operating nut or not installed at the proper elevation, the Contractor shall, at his own expense, make whatever correction is required to remedy the defect promptly, upon notice to do so by the Engineer.

3.2 TESTING

- A. All valves shall be tested in place by the Contractor as far as practicable under conditions for the pipelines in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Engineer.

3.3 OPERATION AND MAINTENANCE MANUALS

- A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintaining instructions, and a complete parts and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements of these specifications.

END OF SECTION 400523

SECTION 401223 - LOW-PRESSURE COMPRESSED AIR PROCESS PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall furnish all materials, tools, equipment, transportation, labor, supervision, and incidentals required to supply, store, install, clean, and test the shop fabricated stainless steel pipe and fittings as shown on the drawings and as specified herein.
- B. Shop fabricated stainless steel piping shall be used for the following applications:
 - 1. Low pressure process air

1.2 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.
- B. The following equipment and related work is specified and furnished under other items:
 - 1. Valves - Section 400523
 - 2. Pipes and Pipe Fittings - Section 402336

1.3 QUALITY ASSURANCE

- A. All shop fabricated stainless steel pipe and fittings shall be furnished by a single manufacturer who is experienced, reputable and qualified in the manufacture and fabrication of the items to be furnished. The pipe and fittings shall be shop fabricated and field installed in accordance with common industry wide practices and methods and shall comply with these specifications. Pipe and fittings shall be as manufactured and fabricated by Douglas Brothers, Portland, Maine; Felker Brothers Corporation, Marshfield, WI; or approved equal.

1.4 SUBMITTALS

- A. The Contractor shall submit for review and approval piping layouts, schedules, shop fabrication drawings, specifications, catalog cuts, and other data necessary to show conformance of the complete piping systems to these specifications. The Contractor's submittal shall include dimensions, fittings, locations of equipment, valves, and appurtenances, joint locations and details, types and locations of supports, coordination with all other work and existing conditions, and all other pertinent technical specifications for the piping systems to be furnished. Submittals shall be in accordance with Items 60 & 61.
- B. Shop fabrication drawings shall show alloys, diameters, pipe wall thicknesses, flanges and other joint preparation details, dimensions, fittings, and other appurtenances to be supplied.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Pipe shall be manufactured from ASTM-A240 annealed and pickled sheets and plates in accordance with ASTM A778 in type 304L stainless steel. Pipe shall be manufactured to nominal pipe sizes as listed in ANSI B36.19, Table 2, and shall have the following nominal wall thicknesses. All SS pipe shall be Sch 10 for both water and air application.
- B. Fittings:
1. Butt weld type manufactured in accordance with ASTM-A774 of the same raw material and in the same thicknesses as the pipe. Long radius elbows up to 24-inch diameter shall be smooth flow; i.e. centerline to end of elbow equals 1.5 times the nominal pipe size. All short radius, special radius, and reducing elbows and long radius elbows greater than 24-inch diameter shall be of mitered construction with at least five (5) miter sections for 90-degree bends, three (3) mitered sections for 45 and 60 degree bends, and two (2) mitered sections for 30 degree and smaller bends. Reducers shall be straight tapered, cone type. Tees, crosses, laterals and wyes shall be shop fabricated from pipe.
 2. Grooved end type manufactured in accordance with ASTM A403. Long radius elbows up to 12-inch diameter shall be smooth flow; i.e., centerline to end of elbow equals 1.5 times the nominal pipe size. Reducing tee fittings shall be shop fabricated from stainless steel pipe conforming to ASTM A312.
- C. The finish on the raw material, manufactured to ASTM A240 will be No. 1, HRAP (hot rolled annealed and pickled) or better. The finish on the completed pipe and fittings shall be as specified in ASTM A778 and A774, respectively.

2.2 FLANGES

- A. Flanged pipe ends shall be made up of type 304L stainless steel slip-on type rolled angle face rings and hot dipped galvanized ductile iron back-up flanges drilled to ANSI 16.1 Class 125 standard. The angle face ring thickness shall be equal to or greater than the wall of the pipe or fitting to which it is welded, and it shall be continuously welded on both sides to the pipe or fitting. The angle leg shall not interfere with the flange bolt holes. The back-up flanges shall be supplied with the following nominal thicknesses.

<u>Nominal Pipe Size (Inches)</u>	<u>Flange Thickness (Inches)</u>
2-1/2 - 3	1/2
4	9/16
6 - 10	5/8
12 - 16	3/4
18 - 20	7/8
24 - 30	1
36	1-1/8

2.3 COUPLINGS

- A. The piping will be shop prepared for pipe couplings where shown on the drawings or specified herein.
1. Sleeve type couplings shall be Dresser style 38 or equal, of standard steel construction with rubber gaskets suitable for 250 deg F air service. Pipe shall be plain end with external weld beads ground smooth to insure proper gasket seating. For pressure pipe lines, sleeve coupling joints will be restrained by the use of harness rods connecting across the joint to flange lugs on adjacent flange joints. Where no adjacent flange joints exist, stainless steel harness lugs shall be welded to the pipe to receive the harness rods. All sleeve couplings, flange lugs, harness rods and hardware will be provided by the Contractor.
 2. Arched band (split-sleeve) type couplings shall be stainless steel of equal or superior alloy and wall thickness as the pipe and will be Depend-O-Lok type as manufactured by Victaulic Depend-O Lok. Couplings will be Fixed - FxF, Expansion - ExE, or Fixed by Expansion - FxE as noted on the drawings or as required. The pipe shall be plain end with external weld beads ground smooth and with S.S. restraining rings shop welded to the piping for fixed type couplings.
 3. Grooved-End Joint Couplings:
 - a. Flexible grooved-end joint couplings shall have Type 316 stainless steel housings, conforming to ASTM A351, A743 and A744, complete with synthetic rubber gasket. (Grade to suit the intended service.) Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. (Couplings shall be placed in close proximity to the vibration source.) Victaulic Style 77S.
 - b. For exterior applications, stainless steel grooved-end joint rigid couplings shall be Type 316 stainless steel housings, conforming to ASTM A351, A743, A744, key designed to clamp the bottom of the groove to provide rigidity, complete with synthetic rubber gasket. (Grade to suit the intended service.) Victaulic Style 489.
 - c. For interior applications, ductile iron grooved-end rigid joint couplings for stainless steel pipe shall have ductile iron housings, conforming to ASTM A395 and A536, key designed to clamp the bottom of the groove to provide rigidity, complete with synthetic rubber gasket. (Grade to suit the intended service.) Victaulic Style 89.

	Style 77S Flexible	Style 489 Rigid	Style 89 Rigid
2 - 2-1/2	500	300	300
3	400	300	300
4	350	300	300
6	200	300	300
8	125	300	300
10	75	300	300
12	125	300	300

2.4 THREADED CONNECTIONS

- A. Threaded pipe, gauge or instrument connections shall be made using stainless steel, 150-pound threaded half-couplings conforming to ASTM A182 or ASTM A276, shop welded to the pipe at the locations shown on the drawings.

2.5 JOINTS

- A. Flanges shall be provided as a minimum at all flanged valves, meters, couplings, and other equipment. Couplings will be provided as shown on the drawings.
- B. Pipe and fitting spools shall be shop fabricated to the fullest extent possible in 40'-0" maximum lengths with 7'-6" maximum widths for efficient commercial transport to the project site. Spools with fittings may exceed 40'-0" so long as length allows commercial transport. Smaller pipe spools shall be provided with joints as shown on the drawings for special handling, installation, and/or disassembly requirements.
- C. All other joints required for shipping, handling and installation of the piping spools shall be flange joints, grooved-end joint couplings, sleeve couplings, or split-sleeve band couplings.

2.6 BOLTING

- A. Bolts, washers, nuts, and other hardware for flange bolting shall be Type 316 SS. Number and size of bolts shall conform to ANSI B16.1 requirements for each size of flange.

2.7 GASKETS

- A. EPDM, 1/8 inch thick, 230 deg F rated for air service.

PART 3 - EXECUTION

3.1 SHOP FABRICATION

- A. After the manufacture of individual stainless-steel fittings and pipe lengths, they shall be pickled by immersion in a tank containing an ambient nitric-hydrofluoric acid solution

made up from Oakite Deoxidizer SS, or equal, and monitored to generally maintain a 25% or higher solution by volume of water. The duration of immersion shall be 15 to 20 minutes and may be supplemented by manually scrubbing or brushing with non metallic pads or stainless steel wire brushes. The acid treatment shall be followed by immersion in a rinse water tank, followed, if necessary, by a spray rinse. The stainless steel products shall then be allowed to air dry to achieve passivation.

- B. Welding of pipe spools shall be performed using welders and procedures qualified in accordance with ASME Section IX. Piping with wall thicknesses up to and including 11-gauge (0.125") shall be welded with the TIG (GTAW) process. Heavier walls shall be beveled according to procedure, roof pass welded with the TIG (GTAW), and have subsequent weld passes performed using the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process. Filler metal of equal or superior ELC grades only shall be added to all welds to provide a cross section at the weld equal to or greater than the parent metal. Weld deposit shall be smooth and evenly distributed; weld reinforcement shall be as follows:

<u>Wall Thickness</u>	<u>Weld Reinforcement (Max.)</u>	
	<u>I.D.</u>	<u>O.D.</u>
Up to 12 Ga. (0.109")	1/16"	3/32"
11 Ga. (0.125") to 3/16" Pl.	3/32"	1/8"
1/4" Plate & Larger	1/8"	3/16"

Concavity, undercut, cracks or crevices shall not be allowed. Butt welds shall have full penetration to the interior surface, and inert argon gas shielding shall be provided to the interior and exterior of the joint. Angle face rings shall be continuously welded on both sides to pipe or fitting. Exterior welds, such as the back side of face rings or flanges and structural attachments, may be welded by the MIG (GMAW) or Metallic Arc (SMAW) process; however, care must be taken to avoid melting through to the interior surface on very light walls. Excessive weld deposits, slag, spatter and projections shall be removed by grinding. Welds on gasket surfaces shall be ground smooth.

- C. Spools shall be fabricated to the "Pipe Fabrication Institute" fabricating tolerances ES-3 (1981).
- D. After shop fabrication into pipe spools, exterior welds shall be manually scrubbed or brushed with nonmetallic pads or stainless steel wire brushes to remove weld discoloration, rinsed with clean water and allowed to air dry.
- E. All fabricated piping shall have openings plugged and flanges secured for storage and/or transport after fabrication. All fabricated piping shall be piece marked with identifying numbers or codes which correspond to the Contractor's layout and installation drawings. The marks will be located on the spools at opposite ends and 180 degrees apart.
- F. The piping supplier during manufacturing, fabrication and handling stages, and the Contractor during handling and installation stages, shall use extreme care to avoid the contact of any ferrous materials with the stainless-steel piping. All saws, drills, files, wire brushes, etc., shall be used for stainless steel piping only. Pipe storage and fabrication

racks shall be nonferrous or stainless steel or rubber lined. Nylon slings or straps or alloy chains or cable shall be used for handling stainless steel piping. After installation, the Contractor shall wash and rinse all foreign matter from the piping surface. If rusting of embedded iron occurs, the Contractor shall pickle the affected surface with Oakite Deoxidizer SS or equal, scrub with stainless steel brushes and rinse clean.

G. Grooved-End Joint Installation:

1. All grooved couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
2. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

3.2 FIELD WELDING

- A. No field welding will be permitted.

3.3 PAINTING

- A. After installation, the Contractor shall paint all steel or iron flanges, couplings, and appurtenances in accordance with Section 09801. Painting of the stainless-steel pipe is not required. However, the Contractor shall be responsible for supplying and installing the stainless-steel piping with a consistently clean surface. Identifying spool piece marks shall be removed with paint thinner or solvents and the entire stainless-steel surface shall be washed with detergent and hot water and rinsed clean.

3.4 TESTING

- A. After installation, the piping system shall be tested at 12 psig by the Contractor according to Specification Section 402336.

END OF SECTION 401223

SECTION 402336 - PIPES AND PIPE FITTINGS

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 WORK:

- A. Types of pipe, tube, and fittings specified in this section include the following:
 - 1. Steel Pipes.
 - 2. Copper Tube.
 - 3. Brass Pipes
 - 4. Cast-Iron Pressure Pipes.
 - 5. Cast-Iron Soil Pipes.
 - 6. Concrete Pipes.
 - 7. Plastic Pipes.
 - 8. Plastic Tubing.
 - 9. Acid-Resistant Pipes.
 - 10. Drainage Tile and Pipes.
 - 11. Grooved Piping Products.
 - 12. Miscellaneous Piping Materials/Products.
- B. Pipes and pipe fittings furnished as part of factory- fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:

1. Welding: Quality welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
 - a. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, the National Certified Pipe Welding Bureau (NCPWB).
2. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
3. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipe and fittings bearing approval label by National Sanitation Foundation (NSF).

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing Manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. Welding Certifications: Submit reports as required for piping work.
- C. Brazing Certifications: Submit reports as required for piping work.
- D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packing with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 STEEL PIPES AND PIPE FITTINGS

- A. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.
- B. Galvanized Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.
- C. Seamless Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.
- D. Galvanized Seamless Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.
- E. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- F. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- G. Stainless Steel Pipe: ASTM A 312; Grade TP 304.
- H. Stainless Steel Sanitary Tubing: ASTM A 270; Finish No. 80.
- I. Yaloy Steel Pipe: ASTM A 714; Class 4; Grade IV.
- J. Steel Water Pipe: AWWA C200 for pipe 6" and larger.

- K. Coal Tar Protective Coatings and Linings for Steel Water Pipe: AWWA C203 for enamel and tape, hot applied.
- L. Chlorinated Rubber-Alkyd Paint System for Steel Water Pipe: AWWA C204.
- M. Cement-Mortar Protective Lining and Coating for Steel Pipe: AWWA C205.
- N. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.
- O. Cast-Iron Threaded Fittings: ANSI B16.4.
- P. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- Q. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- R. Threaded Pipe Plugs: ANSI B16.14.
- S. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
 - 1. Material Group: Group 1.1.
 - 2. End Connections: Buttwelding.
 - 3. Facings: Raised-face.
- T. Steel Pipe Flanges for Waterworks Service: AWWA C207.
- U. Corrosion-Resistant Cast Flanges/Fittings: MSS SP-51, including bolting and gasketing.
- V. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- W. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.
- X. Yelow-Steel Buttwelding Fittings: ASTM A 714.
- Y. Stainless-Steel Buttwelding Fittings: MSS SP-43.
- Z. Cast-Iron Threaded Drainage Fittings: ANSI B16.12.
- AA. Forged Branch-Connection Fittings: Except as otherwise indicated, provided type as determined by Installer to comply with installation requirements.

- BB. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

2.3 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88; Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.
- B. DWV Copper Tube: ASTM B 306.
- C. ACR Copper Tube: ASTM B 280.
- D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
- E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
- F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
- G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
- H. Cast-Copper Solder-Joint Drainage Fittings: For "sovent" drainage systems, ANSI B16.32.
- I. Cast-Copper Flared Tube Fittings: ANSI B16.26.
- J. Bronze Pipe Flanges/Fittings: ANSI B16.24.
- K. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 BRASS PIPE AND FITTINGS

- A. Red Brass Pipe: ASTM B 43.
- B. Cast-Bronze Threaded Fittings: ANSI B16.15.
- C. Cast-Bronze Threadless Fittings: ASTM B 61 or B 62.

2.5 CAST IRON PRESSURE PIPES AND PIPE FITTINGS

- A. Ductile-Iron Pipe: ANSI A21.51; AWWA C151.

- B. Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water: ANSI A21.4; AWWA C104.
- C. Polyethylene Encasement for Gray and Ductile Cast-Iron Piping: ANSI A21.5; AWWA C105.
- D. Cast-Iron Fittings: AWWA C110.
- E. Gray-Iron Fittings: AWWA C110.
- F. Ductile-Iron Fittings: AWWA C110.
- G. Rubber-Gasket Joints: AWWA C111.

2.6 CAST-IRON SOIL PIPES AND PIPE FITTINGS

- A. Hubless Cast-Iron Soil Pipe: FS WW-P-401.
- B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.
- C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.
- D. Cast-Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units; complying with same standards (ASTM A 74).
- E. Compression Gaskets: ASTM C 564.
- F. Lead/Oakum Joint Materials: Provide products complying with governing regulations for use in service indicated.

2.7 CONCRETE PIPES AND PIPE FITTINGS

- A. Reinforced Concrete Pipe: ASTM C 76, Class as indicated, with modified tongue-and-groove compression gasket joints complying with ASTM C 443.
- B. Concrete Pipe: ASTM C 14, Class 2, unless otherwise indicated.
- C. Fittings for Concrete Pipe: Match concrete pipe; provide units produced by same manufacturer, complying with same standards.

2.8 PLASTIC PIPES AND PIPE FITTINGS

- A. Acrylonitrile-Butadiene-Styrene Pipe (ABS): ASTM D 1527.

- B. Acrylonitrile-Butadiene-Styrene Sewer Pipe (ABS): ASTM D 2751.
- C. Cellulose Acetate Butyrate Pipe (CAB): ASTM D 1503.
- D. Fiberglass Reinforced Epoxy Pipe (FRE): ASTM D 2310 and D 2996.
- E. Polybutylene Pipe (PB): ASTM D 2662.
- F. Polybutylene Hot- and Cold-Water Pipe (PB): ASTM D 3309.
- G. Polyethylene Pipe (PE): ASTM D 2104.
- H. Polyvinyl Chloride Pipe (PVC): ASTM D 1785.
- I. Polyvinyl Chloride Water Pipe (PVC): AWWA C900.
- J. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch for water.
- K. ASTM D3035, Standard Spec for PE Pipe (DR-PR) Based on controlled Outside Diameter.
- L. Polyvinyl Chloride Sewer Pipe (PVC): ASTM D 2729.
- M. Polyvinyl Chloride Drain, Waste, and Vent Pipe (PVC): ASTM D 2665.
- N. Chlorinated Polyvinyl Chloride Pipe (CPVC): ASTM F 441.
- O. ABS Pipe Fittings:
 - 1. Schedule 40 Socket: ASTM D 2468.
 - 2. Schedule 80 Socket: ASTM D 2469.
 - 3. Schedule 80 Threaded: ASTM D 2465.
 - 4. Solvent Cement: ASTM D 2235.
 - 5. Solvent Cement (To Join ABS To PVC): ASTM D 3138.
- P. CAB Pipe Fittings: Provide fittings of same material by same pipe manufacturer for same pressure rating.
 - 1. Solvent Cement: ASTM D 2560.

Q. FRE Pipe Fittings: Mechanically fastened union-type non-threaded couplings with "O" ring seals.

R. PB Fittings:

1. SDR 11 Socket: ASTM D 3309.

S. PE Fittings:

1. Butt Heat Fusion: ASTM D 3261.
2. Insert Fusion: ASTM D 3197.
3. Socket Type: ASTM D 2683.
4. Insert: ASTM D 2609.

T. PVC Fittings:

1. Schedule 40 Socket: ASTM D 2466.
2. Schedule 80 Socket: ASTM D 2467.
3. Schedule 80 Threaded: ASTM D 2464.
4. DWV Socket: ASTM D 2665.
5. Sewer Socket: ASTM D 2729.
6. Solvent Cement: ASTM D 2564.
7. Solvent Cement (To Join PVC To ABS): ASTM D 3138.

U. CPVC Fittings:

1. Schedule 40 Socket: ASTM F 438.
2. Solvent Cement: ASTM D 2564.

2.9 PLASTIC TUBING AND TUBE FITTINGS:

A. Polybutylene Tubing (PB): ASTM D 2666.

B. Polybutylene Hot- and Cold-Water Tubing (PB): ASTM D 3309.

- C. Polyethylene Tubing (PE): ASTM D 2737.
- D. Polyvinyl Chloride Tubing (PVC): ASTM D 2740.
- E. PB Fittings:
 - 1. Socket Fusion: ASTM D 3309.
 - 2. Compression: As recommended by manufacturer.
 - 3. Crimp-Type: As recommended by manufacturer.
- F. PE Fittings:
 - 1. Insert: ASTM D 2609.

G. PVC Fittings:

- 1. Insert: ASTM D 2609.

2.10 ACID-RESISTANT PIPES AND PIPE FITTINGS

- A. Cast-Iron Pipe; Acid-Resistant: High-silicon cast-iron pipe of type indicated, complying with ASTM A 518.
- B. Lead Pipe: Acid-resistant chemically-pure hard lead, with 7% antimony.
- C. Glass Pipe: ASTM C 599.
- D. Fittings for Acid-Resistant Pipe: Provide fittings matching pipe, and with equal-or-better acid resistance; comply with same standards where applicable. Unless otherwise indicated, provide fittings produced by manufacturer of pipe, and recommended for service indicated.

2.11 DRAINAGE TILE AND PIPE, FITTINGS, AND ACCESSORIES

- A. Clay Drain Tile: ASTM C 4; Standard Class, unless otherwise indicated; lengths as indicated.
- B. Concrete Drain Tile: ASTM C 412; Standard Quality, unless otherwise indicated; lengths as indicated.

- C. Porous Concrete Pipe: ASTM C 654; Standard Strength, unless otherwise indicated.
- D. Perforated Asbestos-Cement Pipe: ASTM C 508; Type III, unless otherwise indicated.
- E. Perforated Polyvinyl Chloride Pipe (PVC): ASTM D 2729; perforated except where standard sections of pipe are indicated.
- F. Perforated Clay Pipe: ASTM C 700; Standard Strength, unless otherwise indicated.
- G. Perforated Concrete Pipe: ASTM C 444, Type 1; and also ASTM C 14, Class 2.
- H. Perforated Bituminized Fiber Pipe: ASTM D 2311.
- I. Fittings and Accessories for Drainage Tile and Pipe: Unless otherwise indicated, provide fittings matching and of same material as pipe units; comply with same standards, where applicable, except fittings need not be perforated where pipe is required to be perforated.
- J. Tile Joint Accessories: Where open-joint drainage tile is indicated, provide joint accessory units as follows:
 - 1. Heavy-mesh burlap joint covers, with copper wire ties.
 - 2. Coal-tar saturated felt covers, with copper wire ties.
 - 3. Copper screen covers, 18-14 mesh, with copper wire ties.
 - 4. Corrosion-resistant metal spacer-band covers.

2.12 GROOVED PIPING PRODUCTS

- A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems having operating conditions not exceeding 230 deg F (110 deg C), excluding steam piping and any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, seismic joints, flexible connections, expansion joints, expansion compensators, or vibration reducers.
- B. Coupling Housings: Malleable iron conforming to ASTM A 47.
- C. Coupling Housings: Ductile iron conforming to ASTM A 536.
- D. Coupling Housings Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts.

Permit degree of contraction and expansion as specified in manufacturer's latest published literature.

- E. Gaskets: Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.
 - 1. Water Services: EDPM Grade E, with green color code identification.
 - 2. Other Services: As recommended by Manufacturer.
- F. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi.
 - 1. Exposed Locations: Tamper resistant nuts.
- G. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.
- H. Fittings: Grooved or shouldered end design to accept grooved mechanical couplings.
 - 1. Malleable Iron: ASTM A 47.
 - 2. Ductile Iron: ASTM A 536.
 - 3. Fabricated Steel: ASTM A 53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".
 - 4. Steel: ASTM A 234.
- I. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.
 - 1. Malleable Iron: ASTM A 47.
 - 2. Ductile Iron: ASTM A 536.
- J. Grooves: Conform to the following:
 - 1. Standard Steel: Square cut.

2. Lightweight Steel: Roll grooved.
 3. Cast Iron: Radius cut grooved, AWWA C606.
- K. Manufacturer: Subject to compliance with requirements, provide grooved piping products of one of the following:
1. ITT Grinnell Corp.
 2. Stockham Valves & Fittings, Inc.
 3. Victaulic Co. of America.

2.13 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.
1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
- B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.
1. Tin-Lead Solder: ASTM B 32, Grade 50A.
 2. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
 3. Silver-Lead Solder: ASTM B 32, Grade 96TS.
- C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.
1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
- D. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast- iron flanges; raised-face for steel flanges, unless otherwise indicated.
- E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

1. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following:

- a. Fernco, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.

1. Comply with ANSI B31 Code for Pressure Piping.

- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
 - C. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

- A. General: Provide joints of type indicated in each piping system.

- B. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31.
- D. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Mechanically Formed Tee Connections: In lieu of providing tee fittings in copper tubing, Installer may, as option, provide mechanically formed tee connections, providing they are in accordance with the following:
 - 1. Size and wall thickness of both run tube and branch tube are listed by Manufacturer of forming equipment as "Acceptable Application".
 - 2. Height of drawn collar is not less than 3 times wall thickness of run tubing.
 - 3. End of branch tube is notched to conform to inner curve of run tube, and dimpled to set exact penetration depth into collar.
 - 4. Resulting joint is minimum of 3 times as long as thickness of thinner joint member, and brazed using B-CuP series filler metal.
- F. Mechanically Formed Couplings: In lieu of providing couplings in copper tubing, Installer may, as option, provide mechanically formed couplings, provided they are in accordance with the following:
 - 1. Form couplings by first annealing area at end of tube where expansion will occur. Insert tube expander to die size required and expand tube end to accept tubing of same size.
 - 2. Resulting joint is minimum of 3 times as long as thickness of tube, and brazed using B-CuP series filler metal.
- G. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
- H. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Weld pipe joints only when ambient temperature is above 0 deg F (-18 deg C) where possible.
 2. Bevel pipe ends at a 37.5 deg angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
 3. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
 4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
 5. Do not weld-out piping system imperfections by tack- welding procedures; refabricate to comply with requirements.
 6. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.
 7. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.
- I. Weld pipe joints of steel water pipe in accordance with AWWA C206.
- J. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- K. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.
- L. Concrete Pipe Joints: Except as otherwise indicated, comply with applicable provisions of "Concrete Pipe Field Manual" by the American Concrete Pipe Assn.
- M. Corrugated Metal Pipe Joints: Comply with manufacturer's instructions and recommendations.
- N. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
1. Heat Joining of Thermoplastic Pipe: ASTM D 2657.
 2. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.
- O. Glass Pipe Joints: Comply with manufacturer's instructions and recommendations.

- P. Open Drain-Tile Joints: Except as otherwise indicated, provide 1/4" open joint, with top 2/3 of annular space covered by joint accessory material.
- Q. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.3 PIPING INSTALLATION

- A. Install drainage piping (perforated, porous or tile) from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubbs and grooved ends of units up-stream. Lay perforated pipe with perforations down.
- B. Install gray and ductile cast-iron water mains and appurtenances in accordance with AWWA C600.

3.4 CLEANING, FLUSHING, INSPECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
 - 1. Inspect pressure piping in accordance with procedures of ASME B31.
- B. Disinfect water mains and water service piping in accordance with AWWA C601.

3.5 PIPING TESTS

- A. Test pressure piping in accordance with ASME B31.
- B. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - 1. Required test periods is 2 hours.

2. Test long runs of Schedule 40 pipe at 150 psi, except where fittings are a lower Class or pressure rating.
 3. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
 4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- D. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION 402336

SECTION 402400 - CHEMICAL FEED PIPING

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 SUMMARY

- A. Chemical Piping: The contractor, under this item, shall furnish and install all the chemical solution piping from the feeders to the points of application as indicated on the drawings.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, the contractor shall comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions per General Requirements Item Nos. 61 and 97.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chemical Solution piping for Sodium Bisulfite Solution shall be Schedule 80 rigid unplasticized polyvinyl chloride pipe conforming to Type I in the Commercial Standard CS 207-60 published by the United States Department of Commerce, and effective as of February 15, 1960 or any amendments thereafter. All materials, including joints and fittings, shall be suitable for exposure to 38-42% Sodium Bisulfite solution.
- B. Chemical Solution piping for Peracetic Acid Solution shall be 316 Stainless Steel. All materials, including joints and fittings, shall be suitable for exposure to 15% Peracetic Acid solution.
- C. Threaded connections will be used and changes in same class as the pipe. It is the intent of these specifications and be put together in such a way that it can be easily rodded and disassembled in short lengths for cleaning. Pipe and fittings shall be equal to those manufactured by Plastics Piping Systems.

- D. Threaded and solution line valves shall be of the same material as the pipe and of manual diaphragm.

PART 3 - INSTALLATION

- A. The Contractor shall install all chemical feed piping as recommended by the manufacturer, the drawings, and according to industry standards.

END OF SECTION 402400

SECTION 406113 – CONTROL PANELS AND SCADA SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. General. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.
- B. Related Sections include the following:
 - 1. Division 01 – General Requirements
 - 2. Division 26 – Electrical Specifications

1.2 DESCRIPTION OF WORK

- A. This specification details the functional attributes for a new SCADA system including all necessary peripheral equipment for the monitoring and operation of specified data. The system shall be designed for future controls and shall be expandable.
- B. The Main PLC panel and SCADA system shall be provided by the preselected System Integrator. The System Integrator shall be paid for their work under the dedicated contract allowance in accordance with specification section 012100.

1.3 GENERAL REQUIREMENTS

- A. The specifications and drawings outline certain characteristics of the monitoring and control system but do not set forth all the details of system design and the various functions and equipment required. All equipment shall be new and complete with all necessary software, accessories, and appurtenances required for a properly operating system including all items recommended by respective manufactures and not herein specified.
- B. The Contractor shall assume complete system responsibility through a system integrator, and provide all necessary coordination with any and all subcontractors.
- C. The Contractor shall coordinate the work of the system integrator for the installation, interconnection, testing, and calibration of the instruments, and the scheduling of the system integrator's personnel. The system integrator shall be responsible for assuring that this equipment properly meets the functional intent of the specifications. Substitutions on functions specified are subject to review and approval.
- D. The system integrator shall be required to demonstrate a minimum of five years recent, past experience in the design, integration, and commissioning of SCADA, instrumentation and control system, at least five projects of comparable size, type, and complexity to the proposed project.

- E. The system integrator shall have in his employ the capable personnel for detailed engineering, coordination, drafting, procurement and expediting, scheduling construction, testing, inspection, installation, start-up service for calibration and commissioning, and warranty compliance for the period specified.
- F. The Engineer, upon written notice of at least one week's time, may arrange to visit the system integrator's facility to review the progress of the project.

1.4 EXCEPTIONS AND ALTERNATIVES

- A. The manufacturer shall offer a system in accordance with this specification. No exceptions written or implied will be made and the vendor shall be capable of meeting this specification as written.
- B. Should any of the specified manufacturers offer alternatives, equipment or materials, he shall do so in accordance with the specifications and he shall, through the shop drawing approval, list each alternative separately defining the advantages of the alternative and the impact on the overall system configuration. The manufacturers shall provide proof that the use of alternatives would improve control system performance and reduce operating and maintenance costs.

1.5 QUALITY ASSURANCE

- A. Codes and Standards. Perform all work in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with the plans and as specified herein.
 - 1. National Electrical Manufacturers Association (NEMA) Compliance.
 - 2. National Electric Code (NEC) Compliance.
 - 3. Instrument Society of America (ISA).
 - 4. Institute of General Construction and Electronic Engineers (IEEE).
 - 5. Underwriters' Laboratories, Inc. (UL) Compliance and Labeling. Comply with provisions of UL safety standards pertaining to process controller equipment. Provide products and components which have been UL listed and labeled.

1.6 EXPANDABILITY

- A. The system proposed shall be a standard (off-the-shelf) system that is configurable to provide for minor changes and additions during manufacturing, installation, and commissioning phases, and on-site by the Owner's operating personnel.

1.7 SUBMITTALS

- A. Submit shop drawings in accordance with specifications.

- B. Shop drawings are to be complete including details of connections, wiring, piping, size, and dimensions. When correct fabrication of equipment depends upon field measurements, make such measurements and note such dimensions on the drawings prior to submittal for approval.
- C. Complete instrument and control system block diagrams, showing in schematic form, the interconnections between major hardware components. The block diagram shall reflect the total integration of all digital and analog devices in the system. The diagram shall reference all interconnecting cabling requirements for digital components of the system including any data communication links.
- D. All significant equipment to be supplied shall be listed followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity supplied, and any special setup and operation and maintenance characteristics.
- E. Drawings of equipment to be supplied shall include, as minimum, overall dimensional details for each unit including installation arrangements and door mounted operator devices including nameplate designations. Wiring diagrams of all equipment including field device connections shall be included and specific installation wiring responsibilities identified.
- F. Input/output drawings shall indicate terminal numbers and signal identification name.
- G. Arrange, identify, and bind all submittals complete with suitable index.
- H. Software submittals shall provide a complete description of the system on a functional level. It is not the intent of this documentation to describe the individual programs.
- I. The software submittal shall cover the detailed control algorithms, plant reports, and process graphic displays that the system supplier has developed through meetings with the Engineer and Owner.

1.8 TESTING AND TRAINING REQUIREMENTS

A. Fabrication Testing

- 1. Major subsystems shall be individually tested for function and operation in a staging area in the Integrator's facility. The subsystems shall be interconnected as they will be installed in the treatment facility, and testing shall be performed using simulated inputs and outputs to assure subsystem function and compatibility. The Integrator shall furnish a certified copy of the results on each subsystem, indicating model and serial numbers, tests performed, and status of equipment after testing.

B. Job Site Demonstration

1. Following final installation and calibration of the system, the Integrator shall perform a demonstration of system performance. Satisfactory performance shall require the system to perform control functions, monitoring and display functions, alarming, and printout functions for a period of not less than one (1) month of continuous operation. During this demonstration, any system failure or software-related problem shall be corrected and the demonstration resumed. Acceptance of the control system by the Owner shall require that the system operates continuously for a period of one (1) month without non-field or field repairable hardware or software interruption. Substantial completion shall not be awarded until after the Integrator has successfully completed the above required test.

C. Training

1. The Integrator shall include at the site, operator and maintenance training for the wastewater department personnel for two one-day periods, one day after initial startup and one day at a later date, after the system has been in operation. The training shall include system operation, programming procedures for the HMI, the input/output subsystem, peripheral devices, troubleshooting, and hands-on instructions.
2. Provide an additional 16 hours of programming to cover any field changes that the Owner may request. If no field changes are required, then the 16 hours shall be utilized for additional training as required by the Owner.

D. System Calibration and Start-up

1. The Integrator shall provide the initial calibration and startup of the control system by providing personnel to perform the following:
 - a. Supervise the installation and verify the final connections of all signal and power wiring to and from the control system.
 - b. Perform all hardware calibration and diagnostic tests, and make all necessary equipment connections.
 - c. Perform all configuration system tests, including diagnostics.
 - d. Perform the acceptance test as described in the "Job Site Demonstration" section of this specification.
 - e. Test the operation of the Communications Control System and Input/Output Subsystem.

1.9 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall furnish via the Integrator, clear, typewritten, easy-to-understand, tightly bound, hard cover instruction manuals for daily operation and maintenance of system. Specifically, the manuals shall contain explicit instructions and well-diagrammed procedures for process operations, loop tuning, and systems maintenance. The instruction manuals shall include as a minimum the following information.

1. Photographs and data sheets of major system components.
2. Input/Output terminal diagrams.
3. Logic and block diagrams.

4. Manufacturer published operation and maintenance instructions on all equipment.
5. Description of systems operation.
6. Configuration language description.
7. Names, addresses, and telephone numbers of local equipment manufacturer representatives for each device in the system.
8. Listing of expendable materials by form, stock, or model number (e.g. paper, magnetic discs, ribbons, etc.).

1.10 SPARE PARTS

- A. The manufacturer's recommended spare parts shall be supplied with the system along with the following items if they are not part of the recommended spares.
 1. One spare I/O module for each type of digital input, digital output, analog input and analog output used within the system.
 2. Two fuses of each type used by the system.
 3. One power supply for each type used within the system.
 4. One Ethernet switch used within the system.

1.11 FUNCTIONAL DESCRIPTION

- A. Adjustments of the new process variables, set points, on/off control or operating sequences for all pumps, blowers, valves, and related process shall be possible from the new SCADA computer.
- B. The SCADA computer human/machine interface (HMI) shall be configured to allow the operators to perform data acquisition functions such as report generation, alarm management, trending, graphic presentation of process in real-time basis and control functions such as equipment on/off, set point changes, etc. for the process equipment. The computer shall also allow the override functions of control blocks upon the operator's command. Failure of the SCADA computers shall not interrupt the operation of the PLC system in performing control and monitoring functions.
- C. The SCADA system shall allow the plant personnel to monitor all new associated processes and to change set points as required. It shall also provide status conditions, alarm conditions, display of trend and selected loop display. The system shall perform totalizing the recording functions of selected process variables.
- D. The system shall have the capability of storing all new process variables such as pressure, flow and level and shall provide either daily, weekly, or monthly printouts as selected by the operator. Status conditions, display of trends and selected loop display shall be provided.
- E. It shall be possible to manually toggle the "Out of Service" status within the SCADA system for all of the process equipment, instrumentation and areas (such as one of the aeration basins).

- F. For those processes that include automated operation, as described below, manual operation shall always also be allowed. Toggling between manual and automatic operation shall be possible on the related control screen.

1.12 FUNCTIONAL DESCRIPTION – APPLICATION PROGRAMS:

- A. The following set of control descriptions will be incorporated in the SCADA System designed and provided by the system integrator. The following descriptions have been prepared based on specified equipment and existing conditions. The system integrator shall modify this document as required to accommodate actual approved equipment shop drawings.
 - 1. Rotary Screens – The screens operate automatically on a level differential in the screen channel, as monitored by upstream and downstream level sensors.
 - 2. Blowers – The blowers operate automatically to maintain a Dissolved Oxygen (DO) setpoint in aeration tanks. The DO level is received from probes in each tank.
 - 3. Sludge Press – It is intended that the press is started manually and shut off manually, with all interconnected processes running automatically when the press is switched on.

PART 2 - PRODUCTS

2.1.1 SYSTEM HARDWARE

- A. General Panel Requirements
 - 1. Panels shall be completely fabricated, equipment installed, and wired in the manufacturer's factory. All wiring shall be completed and tested prior to shipment. All external connections shall be by way of numbered terminal blocks. Panels shall be UL listed, standard construction, as manufactured by Hoffman or approved equal.
 - 2. In addition to all NEMA standards, the panel shall conform to NEC Article 409 and to the following requirements:
 - a. Minimum metal thickness shall be 14-gauge.
 - b. All doors shall be rubber-gasketed with continuous hinge.
 - c. Wherever practical, enclosures shall be a manufactured item.
 - d. All panels manufactured or fabricated shall be summarized, and the summary together with catalog cuts and/or shop drawings shall be submitted to the Engineer for review and marked by the Engineer to the effect that resubmittal is not required prior to purchase or fabrication.
 - e. Smaller panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.
 - f. Where panels are mounted outside or in unheated areas, they shall be provided with thermostatically controlled heaters that will maintain their inside temperature above 40 F.
 - g. Provide a door switch controlled, LED light and a breaker protected, 120 V 15A amp duplex receptacle within panel.

B. Panel Electrical

1. Power Distribution Within Panels

- a. Each panel will be provided with a 120V ac, 60-Hz feeder circuit from the associated circuit breaker distribution panel provided under Electrical. On each panel, make provisions for feeder circuit conduit entry and provide a terminal board for termination of the wires. Panel shall have a surge protection device.
- b. Provide master circuit breaker and a circuit breaker on each individual circuit distributed from the panel as shown. The circuit breakers shall be grouped on a single subpanel. Provide subpanel placement so that there is a clear view of and access to the breakers when the door is open. Opening the main breaker will interrupt all 120 VAC circuits (there shall be no 120 VAC on terminal blocks from remote devices).

C. Wiring

1. All electrical wiring shall be in accordance with the applicable requirements of the NEC. Wires shall be 600-volt class, PVC insulated stranded copper and shall be of the sizes required for the current to be carried, but not below 12 AWG enclosed in either sheet metal raceway or plastic wiring duct. Wiring for 4 to 20 mA signal circuits shall be twisted shielded pairs not smaller than No. 18 AWG, and be separated at least 6 inches from any power wiring.
2. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks.
3. All panel wiring shall be routed in plastic raceway as manufactured by Carlon or equal.

D. Terminal Blocks

1. Terminal blocks shall be one-piece molded plastic blocks with screw type terminals and barriers rated for 300 volts. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed.
2. Wires shall be terminated at the terminal blocks with crimp type, preinsulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated.
3. Terminal blocks shall be Allen-Bradely Bulletin 1492, Style CD-3 or approved equal.

E. PLC

1. The PLC shall include memory and software to allow customer configurable programming in the field. Reprogramming shall be either by downloading from the SCADA computer over the communications channel or through the use of the programming unit to all PLC's.

2. The PLC shall control its local process through the use of an integral processor and modular real-time process control software.
3. The PLC shall be capable of communicating with the master PLC in continuous polling mode and shall be provided with built-in communication modem.
4. The PLC shall have the ability to have its programming and configuration software updated or replaced by download through the network communications port; either locally, or remotely (via the network) without local operator intervention.
5. The PLC shall perform all on-line local control functions by means of a control program maintained within the unit's memory. In the event of a system or communications failure, it shall continue to control its assigned process and shall store all necessary data for transmission when communication resumes.
7. Each PLC shall be supplied with the sufficient number of I/O modules per the approved I/O schedule plus 10% spare capacity. All analog inputs shall be fully isolated differential types, capable of rejecting General Construction interference normally associated with industrial equipment including, but not limited to, transformers, motor starters contactors, and General Construction heaters. The analog outputs shall be configured for current loop operation (4-20 mA).
6. PLC shall be CompactLogix series, as manufactured by Allen-Bradley.

F. Operator Interface Terminals (OIT):

1. The following screens shall be configured at the OIT:
 - a. Main menu.
 - b. One screen for each related process. The screens shall include equipment run status, run, flow, level, and associated alarms.
 - c. Screens for all process set points.
 - d. Screens for last 24-hour alarms.
 - e. Help screen.
2. The OIT shall be 10" diagonal, color, touch screen equal to A/B PV 1000.

G. PLC Software:

1. PLC software shall consist of automatic analog monitoring logic, operator interface logic, alarm logic, and computer interfaces.
2. PLC software shall include arrangement of storage registers to hold necessary data to update displays, initiate alarms, and store comments and set points from the data input device. The data shall be organized to provide optimum data transmission time and system response time.

3. All PLC software shall be written in an easily understandable, organized manner resulting in efficient use of memory and rapid scan time.
4. The system shall be configured to ensure that all controlled variables and output signals are updated at an interval not greater than once every half-second.

H. Lightning/Surge Protection:

1. General:

Lightning/surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation.

2. Signal line:

All signal lines shall be protected through the use of UTB protectors. These shall be provided at both ends of the signal lines and as close to the instruments as possible.

2.2 OPERATOR STATION

- A. The operator station shall consist of Desktop PC and printer. Provide all misc hardware and software required for a complete and functioning system.
- B. The operator station Desktop PC shall be the most current state of the art equipment (as approved by owner) as required for latest software to operate properly and as a minimum have the following:
 1. Processor - Intell Core I7
 2. Operating System - Windows 8
 3. Memory – 8 GB DDR3 SDRAM
 4. Keyboard and Mouse - wireless
 5. Internal Hard drive - 28 GB Solid State Drive
 6. Monitor - 27” Full HD
- C. The operator station printers shall be the most state of the art equipment (as approved by the owner).
- D. The SCADA system functions shall include as a minimum the following:
 1. Allow operators to precisely monitor and control plant processes.
 2. Allow operators to manage unlimited alarm areas, alarming priorities and remote management of alarms.
 3. Collect and manage data, store historical data, export data to and from data base, and distribute data to reports.
 4. Trend both historical and real time data.
 5. Define levels of secure authorization to various users and operators.

- E. Software
 - 1. The following software packages shall be provided. Substitutions may be allowed with engineer's written permission, to be received prior to bids.
 - a. SCADA software - FactoryTalk View SE
 - b. Alarm Callout - Win911 Pro
 - c. Custom Reports – XL Reporter Professional
 - 2. All software packages shall be compatible with the hardware and operating system specified.

2.3 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. Both the desktop PC and the control panels shall be protected electrically by an on-line UPS. During normal operation the UPS shall convert line power into clean, regulated, on-line, computer grade power. When line power is unacceptable or gone completely, the UPS shall have battery backup to create pure sine wave power with no interruption to the computer. UPS shall be provided by Liebert or approved equal.

2.4 ETHERNET SWITCHES

- A. The system integrator shall provide unmanaged industrial ethernet switches and power supplies as manufactured by NTRON or approved equal.

2.5 SYSTEM SOFTWARE

- A. General:
 - 1. The system supplier shall provide all programming necessary to provide a full operational system for the new process equipment. Software configuration required shall consist of all programs and systems necessary to perform the functions specified.
 - 2. The Contractor, via the supplier, shall assume complete responsibility for successful operation of the system. All programs shall be completely debugged and operable prior to the delivery of the system equipment.
 - 3. System software shall provide for addition, modification, or deletion of application detail without interruption of the processes.
 - 4. The PLC shall remain as the overall system coordinator. Removal of workstation computer shall not affect the operation of SCADA system except the data collection function.
- B. Report Generation System:
 - 1. Reports shall be provided for new process equipment. Final format and variables printed shall be developed by Engineer and Owner with a system supplier. Any calculations required shall be made at the time of printing.

Each page of the report shall have the name of the facility, type of report, time and date the report was prepared, and page number. All logs and summary reports, with the exception of the alarm and equipment status logs, shall be allowed to be initiated manually and canceled from central operator's console.

2. Plant Equipment Maintenance Scheduling Software: Provide maintenance scheduling using spreadsheet format for selected plant equipment and process units with operating time accumulation and periodic printout on the basis of either calendar or running time milestones. The software shall enable the operator to forecast and schedule maintenance tasks and alert operations when scheduled tasks are overdue.
3. The maintenance logs shall be provided for plant process equipment such as pumps, blowers, drivers, generators, and any equipment, which provides "run" status signal to the SCADA system. The plant personnel will input maintenance and frequency into the software program.
4. Alarms: Alarm conditions for new process equipment to be stored for up to 24 hours. In addition, an alarm description, time of occurrence, and time of return to normal shall also be stored. The intent is to accumulate a daily (24-hour) alarm summary for printout or display.
5. Calculated Variables Processing: Calculated variables are to be provided to represent process parameters for which there are no direct analog inputs to the system. These variables utilize real variables, and manually entered constants or laboratory data to compute their value. Examples of calculated variables are metering pumps where speed times and known displacement integrated with respect to time becomes flow quantity in engineering units.
6. The system shall provide historical data recording of new data points. The data file shall be user-selectable as daily, weekly, monthly, or yearly for each point recorded. Each point shall have an individual enable/disable of historical recording. The historical recording shall use a compression deadband technique to reduce frequency and amount of data recorded when insignificant fluctuation in data occurs. The system shall utilize a preconfigured program template. The template shall allow the user an ease access and manipulation of the following: tag names, start time and date, engineering unit, color, scale, and grid.

C. Alarm System:

1. The alarm system shall monitor and report all alarm conditions from new equipment and systems. Alarms and return-to-normal transition reports from the remote process controllers shall be collected at the operator's console. Upon receipt of these alarm reports, the console shall perform several automatic operations, which provide an interface for allowing the operator to interact with these alarm conditions.

2. Alarm classes shall be established at system configuration for those analog or logical signals that are assigned alarm limits, marginal or failed communication link and failure of a hardware device such as input/output module or other major devices. The alarm system will have three classes of alarms; critical, non-critical and process.
3. An audible alarm shall be activated whenever the operator's console receives an alarm report that must be acknowledged by the operator. To silence the audible alarm, the operator depresses the audible silence function key on the work station keyboard. Silencing the alarm, however, does not constitute alarm acknowledgement.

D. Real-time Trending:

1. Real-time trend displays shall plot samples of the selected points in an x-y format. A trend page shall consist of at least four trend plots with each plot using its unique color. The user shall be able to request exact numeric values for any point in the trend by moving an arrow to the point in the graphic.
2. Trends shall be offered in line, bar and text form.
3. Provisions shall be made so that the points and scan frequency shall be assignable by the operator from display.

E. Historical Trending:

1. Provisions shall be made for storing historical data and to recall that data for historical trending and display purposes.
2. Capability to average values to permit longer trending periods shall be provided.
3. The signal, its remote name, as well as maximum, minimum, and engineering units shall be displayed.

F. Display System: Displays will include all process equipment and systems.

1. The system shall be designed to provide for the display of process equipment. These displays shall be the primary means by which real time process information shall be presented to the operator at the operator's console. The displays shall be generated by collecting data from the new PLC.
2. The displays of process graphics are to be configured during the shop drawing phase of the work in conjunction with the Owner and Engineer.
3. All graphic pictures and characters must be editable by the operator from the operator station while the system remains on line. Graphic pages shall be called to the screen by their number, name, or from a menu of available pages.

4. Graphic editor must be menu driven, and contain standard geometric symbols, and making creation, modification, and copying of graphics a simple task.
5. An alarm history display shall be provided which allows the operator to examine the current alarm conditions throughout the entire system. All alarms shall be logged on the alarm printer when they are received, and when they return to normal.
6. The alarm system shall execute three operations whenever an alarm report is received.
 - a. An audible alarm shall be actuated if the alarm report must be acknowledged by the operator.
 - b. Alarms with a priority of “critical,” “non-critical,” or “process” shall be added to the alarm history buffer.
 - c. All alarms are logged on the alarm printer. Alarm information shall be conveyed by changing color of the single value as following:

Flashing Green – Unacknowledged Normal
Steady Green – Acknowledged Return to Normal
Flashing Red – Unacknowledged Alarm
Steady Red – Acknowledged Alarm

The most recent alarm reports in the alarm history file shall be presented on the display monitor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prior to all work of this section, carefully inspect the existing facilities and install work of all other trades and verify that all such work is complete to the point where installation may properly commence.
- B. The equipment shall be installed in accordance with the system integrator’s instruction and located as shown on the drawings, or as approved by the Engineer. Local General Construction shutoffs for power supplies to equipment shall be provided.
- C. Discrepancies:
 1. In the event of a discrepancy, immediately notify the Engineer.
 2. Do not proceed with installation in areas of discrepancy until all such discrepancies are have been fully resolved.
- D. The SCADA system and accessory equipment shall be installed in accordance with the manufacturer’s instructions and located as shown on the drawings or as approved by the Engineer.

3.2 SYSTEM INTEGRATOR'S SERVICES

- A. The system integrator shall furnish the services of the serviceman, all special tools, calibration equipment and labor required for the following:
 - 1. Checking the installation of all components before power is applied.
 - 2. Placing the software and hardware into operation and making necessary adjustments.
- B. Should the equipment fail to operate in accordance with the specifications and manufacturer's data, corrective measures shall be taken by the System Integrator or the defective equipment shall be removed and replaced with equipment which will satisfy the specified conditions.
- C. When all required approvals of this portion of the work have been obtained, and at a time designated by the Owner, thoroughly demonstrate to the Owner's personnel the operation and maintenance of all items installed under the work of this section.

3.3 INSPECTION

- A. Installation: Supervision and assistance to ensure that proper procedures are following during installation of the system.
- B. Start-up: Energize and verify correct and satisfactory operation of all components of the system. This operation shall include verification of the accuracy of all inter-equipment wiring.
- C. Subsystem Commissioning: Place into operation all component subsystems. This operation shall include loading and placing into operation all software and calibration of all system inputs and outputs. Simulation of system inputs and outputs that are not operational during this subsystem commissioning phase shall be allowed provided that all of these simulated inputs/outputs shall be subsequently verified during the system commissioning operation.
- D. System Commissioning: Calibrate and place into operation the complete system. The validity of all data base information in the system shall be checked and corrected as part of this operation. Calibration of all process control loops external to the equipment being supplied by other equipment suppliers will be the responsibility of the System Integrator prior to system commissioning.

END OF SECTION 406113

SECTION 409123.33 - OPEN CHANNEL FLOW METERING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

1.2 SUMMARY

- A. This section includes furnishing and installing a Parshall Flume in an open channel for metering influent flow, ultrasonic flow sensor, transmitter, totalizer and other appurtenances required for a complete installation.
- B. Parshall Flume Design Conditions:
 - 1. The wastewater flow rates measured by the Parshall Flume will range from the minimum daily flow of 0.15 MGD to the peak hourly flow of 4.90 MGD.
 - 2. Parshall Flume shall be cable measure flow under free flow and submerged flow conditions.
- C. It is the intent of this contract that the final installation shall be complete in all respects and the Contractor shall be responsible for minor details and any necessary special construction not specifically included in the Drawings or Specifications.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- B. The supplier of the flow metering systems shall have had at least five (5) years' experience in production of similar items to those described herein.
- C. All equipment shall be of the latest and most modern design. All sensor/transmitter assemblies shall be of the same manufacturer and general model type.

1.4 RESPONSIBILITY AND COORDINATION

- A. Under this Contract, the Contractor shall be responsible for the purchase, storage, and installation of the Parshall Flume, ultrasonic flow sensor, transmitter, totalizer and any accessories required. The devices shall be completely wired, tested, and be suitable for operation. The wiring between the devices and the power supply, and the wiring between

the ultrasonic flow sensors, totalizer and transmitters shall be the responsibility of the Contractor. The Drawings and Specifications are intended to illustrate and define the equipment installation; however, the Contractor shall properly install, adjust, and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations from the Specifications.

1.5 SUBMITTALS

- A. The Contractor shall submit manufacturer's technical data and application instruction in accordance with the General and Supplementary Conditions and Division 1 Specifications and any additional information listed herein.
- B. Product Data: Submit manufacturer's technical data and application instructions.
- C. Shop Drawings: All shop drawings shall clearly identify the specific equipment and material being supplied, the quantity being supplied, and all accessories, dimensions, descriptions, mounting and connection details, and any other information necessary to determine compliance with the plans and specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Parshall Flume Manufacturers:
 - 1. Plasti-Fab, Inc.
 - 2. Warminster Fiberglass
 - 3. Or Engineer approved equal.
- B. The flow transmitter and sensor shall be as manufactured by:
 - 1. Magnetrol International, Model R82, represented by Chaltron Systems, Inc., www.chaltron.com.
 - 2. Or Engineer approved equal.
- C. Totalizing Recorders Manufacturer:
 - 1. Magnetrol International, Model CSI-NANO-001, represented by Chaltron Systems, Inc., www.chaltron.com.
 - 2. Or Engineer approved equal.

2.2 METERING FLUME

- A. The metering flume shall be embedded in poured concrete and shall be a fiberglass reinforced polyester Parshall Flume. The flume shall include an adjustable stainless steel ultrasonic flow sensor mounting bracket. The flume shall have a UV stabilizer in the resin to provided protection from UV radiation. The inside surface shall be smooth and free from irregularities and the outside surface shall be provided with clips suitable for anchoring the flume in concrete. The flume shall be reinforced to maintain dimensional integrity with a full head of water. The flume shall have a minimum wall thickness of 1/4" throughout.
- B. Provide one (1) flow metering flume as described below complete with flume, ultrasonic level sensor, and transmitter.
- C. Physical Properties

1. FRP shall be approximately 30% fiberglass, 70% polyester resin and have all surfaces smooth, resin rich, free of voids and porosity, without dry spots, crazes, or unreinforced areas. Minimum properties required for FRP are:

Property	Minimum Value	Test
Tensile Strength	15,000 psi	ASTM D-638
Flexural Strength	20,000 psi	ASTM D-790
Flexural Modulus	1,000,000 psi	ASTM D-790
Compressive Strength	22,000 psi	ASTM D-695
Notched Izod	9 ft-lbs/in	ASTM D-256
Water Absorption	0.13%	ASTM D-570

D. Influent Parshall Flume

1. The flume section shall have a throat width of 9" and have an overall length as specified on the contract drawings. The flume section shall be capable of measuring flows up to 4.90 MGD.

2.3 FLOW SENSOR AND TRANSMITTER

- A. The transmitter electronics shall be based on 26GHz Pulse Burst Radar technology and shall be immune from changes in dielectric, specific gravity, and vapors.
 1. Configuration shall be through a 2-line by 16-character local display with four push button controls and/or through an optional HART® interface using PACTware™ software in conjunction with a HART® modem or stand alone with a HART® hand-

held terminal. Interface with a PC or hand-held terminal shall not be required to configure or program the instrument.

2. Calibration, with the need to move the process liquid, shall not be necessary.
3. Bench configuration of all configuration parameters of the unit (less false target rejection), prior to installation, shall be possible.
4. False Target Rejection will be performed effectively without the need for a secondary device (PC, laptop computer, HART[®] hand-held).
5. The transmitter will have the ability to effectively track rapid rates of level change up to 180"/minute.
6. The transmitter housing shall be directly coupled to the sensing antenna.
7. The unit shall be capable of rotating and positioning the polarization of the radar signal on the surface level, to optimize performance and facilitate installation and setup, at any point in 180° without removing the instrument from its secured, in-process mounting position.
8. The rotation and positioning of the polarization path shall be accomplished through the use of an internal indexed dial, fully accessible from the top of the unit. Units not allowing for rotation and positioning of the polarization path through an internal indexed dial shall not be acceptable.
9. The sensor shall consist of a microprocessor-based electronic Radar transmitter 26 GHz housed in a rugged, watertight, dust-tight, submersible, corrosion resistance (NEMA 4X, 6, and IP67) enclosure.
10. The transmitter shall operate as a 2-wire, 4–20 mA device from 16 to 36VDC. The 4–20 mA output shall operate from 3.8mA to 20.5mA (per Namur NE43) and have diagnostic fault values of 3.6mA, 22mA, and HOLD last value.
11. The minimum blocking distance shall be 15" as measured from bottom of the process connection (NPT) threads.
12. The unit shall have the ability to be mounted to reduce the unusable area near the tank top to 3" or less.
13. The sensor shall include variable blocking distance to ignore echoes from within a programmable distance from the sensor.
14. The maximum measuring range shall be 40'.
15. The transmitter will be approved for FM and CSA General Purpose, Intrinsically Safe (CL I, Div 1) and Non-Incendive (CL I, Div 2).

16. The sensor shall transmit and receive a radar signal to accurately measure fluid depth at the monitoring site. The level measurement span shall be from 0–40' with the following characteristics
 - a. Linearity – $\pm 0.2''$ or 0.05% of tank height
 - b. Measured Error – $\pm 0.2''$ or 0.05% of tank height
 - c. Resolution – 0.01''
 - d. Repeatability – $\pm 0.2''$ or 0.05% of tank height
17. The ambient temperature rating shall be -40°F to +175°F.
18. The sensor shall not require built-in temperature compensation to automatically compensate for air temperature changes.
19. The sensor shall have manual gain and averaging adjustments to maximize performance in the presence of steam, turbulence, and other process variables.
20. The sensor shall also have adaptive averaging capability that automatically adjusts for changing process conditions for real time.

B. Transducer

1. The antenna shall be a fully encapsulated horn style; all wetted surfaces will be Polypropylene or Tefzel and be rated from vacuum to 200 psig (-1 to 13.8 bar and -40°F to +200°F).
2. The antenna will be a radome design and shall utilize a dielectric window to maximize performance. Units without the radome/dielectric window functionality will not be acceptable.
3. Connection size for the unit shall be 2" NPT.

C. Indicating, Totalizing Recorders

- a. The paperless recorder shall be supplied with (4) universal inputs and (14) virtual channels that can be configured for calculations, totalizers and counters.
- b. The recorder shall be a compact design with a 3.5" TFT display and include horizontal and vertical trends, bar graphs, numeric and alarm status displays.
- c. The recorder shall have a 50 Mb internal memory, with Ethernet communications and a USB removable data storage facility. Historical data review software shall be included.

- d. The recorder shall be an Invensys Eurotherm Nanodac or approved equal. The recorder shall be mounted in a Nema 4X Fiberglass Enclosure suitable for wall mounting with an IP67 front USB port.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The equipment shall be installed in accordance with the plans and the manufacturer's recommendations.

3.2 MANUFACTURER'S SERVICES

- A. The ultrasonic flow sensor and transmitter manufacturer shall provide the services of a qualified service engineer to supervise and inspect the equipment installation to insure that it is installed in accordance with the manufacturer's recommendations.
- B. The manufacturer's service engineer shall field calibrate all equipment specified under this Section. This service shall be performed at the request of the Project Engineer at the time of complete plant startup at the end of the last construction contract. A calibration certificate shall be submitted to the Project Engineer for each piece of equipment. The service engineer shall also make all adjustments necessary to place the equipment in trouble-free operation. In addition, the equipment manufacturer shall provide a qualified service engineer to train the plant operating personnel in the proper care, repair, calibration and operation of the equipment. This service shall be provided at the location and time requested by the Owner.

3.3 OPERATION AND MAINTENANCE MANUALS

- A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list.

END OF SECTION 409123.33

SECTION 409123.36 - ULTRASONIC LEVEL SENSOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes the furnishing and installation of an ultrasonic level sensor (by the General Trades Contractor) at locations shown in the drawings. It also includes the furnishing of necessary start up services and training of operating personnel in operation and maintenance of the equipment.
- B. It is the intent of this contract that the final installation shall be complete in all respects and the General Trades Contractor shall be responsible for minor details and any necessary special construction not specifically included in the Drawings or Specifications.

1.3 QUALITY ASSURANCE

- A. All work performed under this section shall comply and be in accordance with all approved trade practices and manufacturer's recommendations.

1.4 STANDARDIZATION

- A. All equipment shall be of the latest and most modern design. All transmitters shall be of the same manufacturer and general model type.

1.5 SUBMITTALS

- A. The level sensor and indicators shall have an identifying tag (white plastic with black letter engraved on it) mounted on the instruments providing the following information:
 - 1. Manufacturer's name
 - 2. Part number
 - 3. Serial number
 - 4. Calibrated range
 - 5. Tag number

PART 2 - PRODUCTS

2.1 RESPONSIBILITY AND COORDINATION

- A. Under this contract, the General Trades Contractor shall be responsible for the purchase, storage and installation of all level sensor, indicators and any accessories required. Each device shall be completely wired, tested and be suitable for operation. Wiring between the level sensor and RMT is the Electrical Contractor's responsibility. The drawings and specifications are intended to illustrate and define the equipment installation, however, the Contractor shall be responsible for all the details which may be necessary to properly install, adjust and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations for the specifications.

2.2 ULTRASONIC LEVEL SENSOR AND TRANSMITTER

- A. The ultrasonic level sensor shall operate on the principal of calculating distance by measuring the elapsed time between transmission of the series of signal pulses and reception of the returning echo. The calculated distance shall include compensation for air temperature to yield a true distance. The sensor shall interface directly with the level transmitter which provides all necessary signal conditioning, filtering, checks for lost echoes, engineering units conversion and switchpoint relays.
- B. The level sensor supplied under this contract shall conform to the following specifications unless otherwise directed by the Engineer.
 - 1. Range: 0-40 ft.
 - 2. Operating Frequency: 30 KHZ.
 - 3. Sample Rate: Sample Rate 2 KHZ.
 - 4. Mounting: Direct bracket mounting.
 - 5. Electronics Housing: Enameled aluminum.
 - 6. Operating Pressure: 7 PSIG Max.
 - 7. Standard Operating Temperature: -4°F to 140°F.
 - 8. Temperature Compensation: Silicon temperature sensor located behind acoustic membrane.
 - 9. Power Supply: Transmitter provides power input to sensor.
 - 10. Cable: As recommended by vendor.

11. Manufacturer: Endress & Hauser DU42 (HL) type or an approved equivalent.
- C. The level transmitter supplied under this contract shall conform to the following specifications unless otherwise directed by the Engineer.
1. Enclosure: NEMA 4X, wall mounted.
 2. Power Requirements: 115 VAC, 60 HZ, 6 VA
 3. Operating Temperature: -5°F to 160°F
 4. Accuracy: 1% of span typical
 5. Display: 4-digit LCS meter, scalable to user's engineering units.
 6. Output: 4-20 mA DC, direct acting into 0-500 Ohms.
 7. Linearity: 1% of span
 8. Repeatability: 0.1% of span
 9. Manufacturer: Endress & Hauser LTU 675 type or an approved equivalent.

PART 3 - EXECUTION

3.1 MANUFACTURER'S SERVICES

- A. The level sensor manufacturer shall provide the services of a qualified service engineer to supervise and inspect the equipment installation to insure that it is installed in accordance with the manufacturer's recommendations.
- B. The manufacturer's service engineer shall field calibrate all equipment specified under this section. This service shall be performed at the request of the Project Engineer at the time of complete plant start up at the end of the last construction contract. A calibration certificate shall be submitted to the Project Engineer for each piece of equipment. The service engineer shall also make all adjustments necessary to place the equipment in trouble-free calibration and operation of the equipment. This service shall be provided at the location and time requested by the Owner.

3.2 OPERATION AND MAINTENANCE MANUALS

- A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements.

3.3 SPECIAL TOOLS AND EQUIPMENT

A. The following shall be provided as part of the equipment package.

1. One (1) complete set of all circuit boards used
2. One (1) complete set of special tools and equipment required for calibration and maintenance
3. One (1) year supply of all consumable material and parts

END OF SECTION 409123.36

SECTION 412213 - CRANES

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 WORK INCLUDED

- A. Equipment items as listed below by Equipment Mark Number:
 - 1. Crane, Bridge, Underhung, 2 TON.
- B. Roughing-in and installation of equipment with labor, services, and incidentals necessary for complete and operational equipment installation.
- C. Wiring and switching between equipment and utilities.

1.3 QUALITY SERVICE

- A. Experience: Equipment shall be produced by a manufacturer of established reputation with a minimum of five years' experience supplying specified equipment.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Submit Product Data in accordance with Division 1 - General Requirements of these specifications.
- B. Operation and Maintenance Manual:
 - 1. Provide complete parts, operating, and maintenance manual covering equipment at time of installation including, but not limited to:
 - a. Description of system and components.
 - b. Schematic diagrams of electrical and compressed air systems.
 - c. Manufacturer's printed operating and maintenance instructions.
 - d. List of original manufacturer's parts, including suppliers' part numbers and cuts, recommended spare parts stockage quantity and local parts and service source.
 - 2. Assemble and provide copies of manual in 8-1/2 by 11 inch format. Foldout diagrams and illustrations are acceptable. Manual to be reproducible by dry copy method. Provide copies per provisions of Division 1 - General Requirements.
- C. Shop Drawings: Submit shop drawings in accordance with Division 1 - General Requirements of these specifications.

1.5 WARRANTY

- A. Warrant work specified herein for one year from substantial completion against defects in materials, function and workmanship.
- B. Warranty shall include materials and labor necessary to correct defects.
- C. Defects shall include, but not be limited to noisy, rough or substandard operation; loose, damaged, and missing parts; and abnormal deterioration of finish.
- D. Submit warranties in accordance with Division 1 - General Requirements of these specifications.
- E. All parts shall be readily available locally in the United States.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery equipment in manufacturer's containers appropriately packaged and/or crated for protection during domestic shipment and storage in humid, dusty conditions.

1.7 LABELING

- A. Nameplate: Manufacturer shall securely attach in a prominent location on each major item of equipment a noncorrosive nameplate showing manufacturer's name, address, model number, serial number, and pertinent utility or operating data.
- B. Crane capacity shall be painted with letters and numbers 3 inches high minimum on both sides of the boom web.
- C. All electrical equipment and materials will be new and shall be listed by Underwriter's Laboratories, Inc. (U.L.) in categories for which standards have been set by that agency and labeled as such in the manufacturer's plant.

PART 2 - PRODUCTS

2.1 CRANE, BRIDGE, SUSPENDED TYPE

- A. Contractor to coordinate with Engineer.

PART 3 - EXECUTION

3.1 BRIDGE CRANE DESIGN

- A. Bridge crane shall not be braced against the building. Bridge crane shall be self-supporting in all directions.
- B. The bridge crane reactions to the structure shall only be at the bridge crane column base plates. The reactions shall consist of vertical and lateral forces. Moments, over-turning moments, and/or torsional forces shall not be transferred to the structure.

3.2 INSPECTION

- A. Coordinate location of rough-in work and utility stub-outs to assure match with equipment to be installed.
- B. Inspect delivered equipment for damage from shipping and exposure to weather. Complete delivered equipment wish packing lists and specifications to assure receipt of all items.

3.3 INSTALLATION

- A. Install equipment in accordance with plans, shop drawings and manufacturer's instructions.
 - 1. Positioning: Place equipment in accordance with any noted special positioning requirements generally level, plumb and at right angles to adjacent work.
 - 2. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging equipment or adjacent work.
 - 3. Anchorage: Attach equipment, as directed by Architect/Engineer, to prevent damage resulting from inadequate fastening. Installation fasteners shall be installed to avoid scratching or damaging adjacent surfaces.
 - 4. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.4 TESTING

- A. After final connections are made and prior to authorizing payment, specified equipment shall be tested for compliance with specification in the presence of the Architect/Engineer using acceptance procedures provided by the manufacturer.

3.5 CLEANUP

- A. Touch-up damage to painted finishes.
- B. Wipe and clean equipment of any oil grease, and solvents and make ready for use.
- C. Clean area around equipment installation and remove packing or installation debris from job site.
- D. Notify Architect/Engineer for acceptance inspection.

3.6 TRAINING

- A. Direct the Technical Representative to provide two (2) hours of training to designated Owner's maintenance personnel in operation and maintenance of the equipment. Coordinate, with Owner, training schedule and list of personnel to be trained.

END OF SECTION 412213

SECTION 415113 - AUTOMATIC SAMPLER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

1.2 SUMMARY

- A. This section includes the furnishing, installation where shown on the drawings, and testing, as deemed necessary by the Engineer, the wastewater monitoring equipment listed in the materials portion of this section.
- B. It is the intent of this contract that the final installation shall be complete in all respects and the contractor shall be responsible for minor details and any necessary special construction not specifically included in the Drawings or Specifications.
- C. The location of the refrigerated automated samplers shall be as follows; Influent Sampler, and Final Effluent Sampler. specifically, the two samplers shall be located:
 - 1. Influent after rotary screens in the screenings channel in the Screen Building.
 - 2. Final Effluent before effluent weir in the disinfection channel.

1.3 SUBMITTALS

- A. Shop Drawing and Manufacturer's Data
 - 1. Manufacturer's package addressing all plant additions, deletions, or modifications to the Project Manual's Drawings and Specifications.
 - 2. Manufacturer's qualification package including a written guarantee.
- B. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 017823, Maintenance Manuals.

1.4 QUALITY ASSURANCE

- A. Manufacturing facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store all instruments in a dedicated structure with space conditioning to meet the recommended storage requirements provided by the manufacturer.
- B. Any instruments that are not stored in strict conformance with the manufacturer's recommendation shall be replaced.

1.6 PROJECT OR SITE CONDITIONS

- A. Provide instruments suitable for the installed site conditions including but not limited to material compatibility, site altitude, process and ambient temperature, and humidity conditions.

1.7 CALIBRATION AND WARRANTY

- A. The sampler shall have standard one-year warranty from date of shipment and if the sampler is commissioned by a factory certified technician, the warranty is extended to three years from the date of shipment

1.8 MAINTENANCE

- A. Provide all parts, materials, etc. necessary for maintenance and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.
- B. Scheduled maintenance:
 - 1. On a monthly basis the sampler shall require no more than a visual inspection, if necessary, cleaning.
- C. Unscheduled maintenance:
 - 1. Pump tube replacement (peristaltic pump only).
 - 2. Dosing chamber cleaning (vacuum only).
 - 3. Rotor removal and cleaning.
 - 4. Clean distributor arm.

1.9 LIFE CYCLE MANAGEMENT

- A. Instrument documentation, manuals and product status information shall be accessed via a web enabled system with a license. The instrument-specific information shall be accessed via its serial number. When services are provided by an authorized service

provider the services information like subsequent field calibrations shall be archived and accessible via this web enabled system.

PART 2 - PRODUCTS

2.1 SYSTEMS/ASSEMBLIES

A. Manufacturer

1. Samplers shall be Hach Sigma AS950 All Weather Sampler with 5.5 gallon bottle and heater (with options as outlined below.
2. Engineer-Approved equal

B. Performance criteria

1. Sample cooling: Maintain sample liquid at 4°C (39°F) in ambient temperature -15 (5°F) to 40°C (104°F) maximum.
2. Sampling methods:
 - a. Vacuum pump/peristaltic pump include event, single and multiple samples and use of the sampling table.
 - b. Vacuum pump additionally includes time proportion and volume proportion sampling.
 - c. Peristaltic pump additionally includes time, volume and flow proportion sampling.
3. Sample volume shall be variable based on sample pumping technology:
 - a. When peristaltic pumping is employed it shall be programmable in 10 mL increments from 10 to 10,000 mL.
 - b. When vacuum pumping is employed is shall be programmable in 10 mL increments from 20 to 350 mL.
4. Sample volume repeatability (peristaltic or vacuum): $\pm 5\text{ml}$ (0.17oz) or 5% of the set volume.
5. Peristaltic pump vertical lift: maximum transport velocity 0.6 m/s (>1.9 ft/s), 8.0 m (26 ft.) suction head using 30 ft. of 3/8" PVC or EPDM intake tubing.
6. Vacuum pump sample transport velocity: 0.6 m/s (1.9 ft/s) at 30m (98 ft. of 3/8"PVC or EPDM intake tubing).

C. Certifications

1. AC power supply: CSA (“C” and “USA”), UL (UL 60950-1) (“C: and “US”), and UL (UL508).

D. Environment

1. Medium temperature range: 2 to 50 °C (36 to 122 °F).
2. Storage temperature: -20 to 60 °C (0 to 140 °F).
3. Relative humidity: 10 to 95%, non-condensing.
4. Ambient temperature range: -30 to 50 °C (-20 to 120 °F).
5. Ingress protection: NEMA 4X.
6. Electromagnetic compatibility: Interference emission and interference immunity as per EN 61326-1:2006, Class A for industry.

2.2 MANUFACTURED UNITS

A. The sampler shall be an all in one unit with controller and sampling in separate compartments.

1. The sampler housing shall be all-weather ASA-PC high-impact plastic and shall have the refrigeration components and copper plumbing corrosion protected with conformal polyurethane coating. The refrigerated cabinet shall be insulated with 2-inch rigid foam insulation on the walls and bottom and 5 inches on top. The refrigeration system shall be located in a separate, upper compartment from the sample compartment and cool the sample compartment through forced air convection. For areas with sub-zero temperatures, the standard refrigeration unit shall also contain a compartment heater.
2. An air sensing thermostat is capable of maintaining the sample enclosure within specified limits that will be set through the HMI. Samplers whose temperature control is not set via HMI to measure the sampling chamber are not acceptable.
3. Samplers that cannot measure the sample temperature are not acceptable.

B. The controller shall be rated NEMA 4X and enclosed in a housing that is watertight, dust-tight, corrosion and ice resistant with the sampler doors in the closed position.

1. The sampler will be designed for indoor and outdoor use.
2. The sampler shall have a 9 line high contrast backlit HMI display making the measurements visible in direct sunlight. The user interface is self-prompting/menu driven program using four function keys, and navigator dial. Samplers that are not configured with the HMI are not acceptable.

3. The sampler memory shall store up to 8 data logbooks with each 150,000 measured values and dates/times, the stored data can be visualized on the sampler display as a graph or table. All other sampling activities including events and sampling statistics shall be stored in program and event logbooks.
- C. The sampler shall store up to 100 sampling program entries while the main program shall run up to 24 sub-programs simultaneously.
 - D. Sample pacing modes shall include composite and discrete with multiple bottle time, multiple bottle flow, single bottle time, single bottle flow, flow with time over ride, variable interval, user start/stop, and external set point.
 1. Manual grab sample can be made to deliver a grab sample to a specific bottle location.
 2. The intake air purge shall be performed automatically before and after each sample, allowing for complete drainage of the intake line to prevent cross-contamination between samples. The duration shall automatically compensate for varying intake line lengths.
 3. The sample collection cycle shall be repeated from one to three times if a sample is not obtained on the initial attempt.
 - E. The sampler shall have a choice of 8 bottle configurations.
 - F. The refrigerated sampler shall be available in one of two sample collection options.
 1. High-speed peristaltic pump for collection of the liquid sample.
 2. High-speed vacuum pump for collection of the liquid sample.
 3. Samplers that cannot be interchanged between high speed vacuum and high-speed peristaltic pumps are not acceptable.
 - G. The method of sample detection shall be conductive or capacitive (vacuum pump) or pressure (peristaltic pump).
 - H. Power supply: 100-120/200-240 VAC +/- 10%, 50/60 Hz.
 - I. An internal real time clock will be maintained for a minimum of five years.
 - J. The basic unit shall include two galvanically isolated analog and two galvanically isolated binary inputs, with options to include up to 4 Memosens® sensors.
 - K. The basic unit shall include two galvanically isolated binary outputs with additional optional outputs:
 1. Up to six current outputs shall be available as an option.

2. Up to two change-over contact relays.
- L. Digital communications protocols available shall include the following without using an external converter. Digital communication shall be available as a native output from the sampler. Use of an external third-party signal converter is not acceptable.
1. EtherNet/IP with webserver.
 2. EtherNet/IP communication shall be supported with the Electronic Data Sheet (EDS) file available for download directly from the sampler. The Add-On Profile (AOP) for integration shall be a Level 3 profile to simplify control system integration.
 3. The EtherNet/IP communications shall also be supported with Add-on Instructions (AOI) files and pre-configured faceplates for ease of control system integration.
- M. Data shall be formatted as required to communicate via Ethernet TCP/IP. The manufacturer shall coordinate with the plant integrator to map data for SCADA interface.
- N. Suction lines; choice of internal diameter (3/8", 1/2", 5/8" or 3/4") and material (PVC or EPDM) in 33 ft. lengths with stainless steel strainers.
- O. Device configuration and logbooks can be saved or restored.
1. An SD card slot shall be provided for configuration downloads, logbook downloads and for embedded software upgrades in the field.
 2. Data management shall be available via a CDI link directly to PC using a serial port and communications interface. (Such as Endress+Hauser FieldCare® Data Management software and Commubox FXA291).
- P. Temperature and pH measuring (Locations 1,2 and 3) complete with:
1. Digital pH sensor with integrated temperature sensor and Memosens technology, Endress + Hauser CPF81D, or equal
 2. Measuring Cable
 3. Immersion Assembly
 4. Include Memocheck service tool for WRF personnel to check the measuring system
- Q. Ammonium and Nitrate measuring system complete with:
1. Digital ammonium and nitrate sensor with Memosens technology, Endress + Hauser CAS40D, or equal
 2. Immersion Assembly and holder system

2.3 ACCESSORIES

- A. An accessory system shall be available for sampling from a pressurized line.
- B. The sampler shall have a choice of 3 configurations of sampler stands.
- C. The sampler shall have the option for additional inputs including up to 4 Memosens® protocol industrial sensors that can be added in the field.
- D. The sampler shall be available with key locks for both the upper and lower compartments.
- E. Outside and direct sample temperature measurement shall be available as an option.
- F. Optional battery backup system ensures uninterrupted operation in the event of power failure.

2.4 SOURCE QUALITY CONTROL & CALIBRATION

- A. Any standards and cleaning solutions will be supplied with MSDS data sheets.

2.5 SAFETY

- A. All devices shall be suitable for operation in a non-hazardous area.
- B. Device failure modes, self-monitoring characteristics and diagnosis shall follow NAMUR standard NE 43.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the complete set of plans, the process fluids, pressures, and temperatures and ensure instruments are compatible with installed process and environmental conditions.
- B. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

3.2 INSTALLATION

- A. Contractor will install the sampler in strict accordance with the manufacturer's instructions and recommendation.

- B. The sampler must be installed in a suitable manner so that the sampler is not directly installed over the sampling area.
- C. The services of a qualified Engineer shall be furnished at no cost to the Owner by the components manufacturer for a minimum of one (1) working day for the purpose of instructing and assisting the Contractor and Owner's personnel in the handling, installation, start up, and proper operation of the equipment.

END OF SECTION 415113

SECTION 432357 - PROGRESSIVE CAVITY PUMPS (SLUDGE FEED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section specifies two (2) single stage positive displacements progressive cavity pumps, complete with electric motors, VFDs, control panels and all specified appurtenances, complete and operable as shown on the plans and specified herein.
- B. The pumping units shall be of the self-priming, positive displacement, progressive cavity type specifically designed with a stator consisting of two halves that simplifies the assembly and disassembly when required.
- C. Furnish all labor, material, equipment, products, incidentals and testing required and necessary to provide a complete and operational system. Install where noted on the drawings and as specified within these specifications.
- D. The unit shall include all manufacture's motors, starters/electrical work necessary connecting conduit, wiring controls, control panels within requirements of Division 26.
- E. Coordinate all work with this equipment and any other associated equipment, installed and specified under other sections of these specifications.
- F. The Supplier shall examine the Site conditions, intended application, and operation of the pump system and recommend the pump which will best satisfy the indicated requirements.

1.3 REFERENCES

- A. AISI American Iron and Steel Institute
- B. ASTM American Society for Testing and Materials
- C. IEEE Institute of Electrical and Electronic Engineers
- D. NEMA National Electrical Manufacturers Association
- E. SSPC Steel Structures Painting Council

- F. AGMA American Gear Manufacturers Association

1.4 SYSTEM DESCRIPTION

- A. All progressive cavity (sludge feed) pumps shall be supplied by the same manufacturer.
- B. Each pump shall include a fabricated steel base plate, flexible couplings with block design closed connection, gear reducer, and motor. Motor shall be mounted with pump and gear reducer on baseplate at pump manufacturer's facility and shipped as one unit.
- C. Design Requirements:
 - 1. Select system components on the basis of information specified herein, and on the Contract Drawings.
 - 2. Give special consideration to available horizontal clearances.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections.
- B. Product Data:
 - 1. Manufacturer's data including materials of construction and equipment weight.
 - 2. Performance curves developed for the specific application. Performance curves shall plot speed, capacity, head, and horsepower required for the specified operating range.
 - 3. Complete description in sufficient detail to permit an item-by-item comparison with Specification.
 - 4. Deviations from Contract Documents.
 - 5. Motor data.
 - 6. Warranty
- C. Shop Drawings:
 - 1. Layout drawing for all equipment showing installation details and anchorage.
 - 2. Dimensions and required clearances.
 - 3. Equipment weights and lifting points.
 - 4. Electrical wiring diagram.

5. Manufacturer's installation and testing instructions.
- D. Maintenance and Operating Instructions, including the following additional information:
 1. Recommendations for short and long term storage.
 2. Explanation of operating safety considerations.
 3. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.
 4. Repair parts and maintenance materials.
 5. Troubleshooting data.
 6. Repair data.
 7. Manufacturer's warranty.

1.6 QUALITY ASSURANCE

- A. Provide equipment that is a standard product of the manufacturer.
- B. Manufacturer Qualifications: Five years demonstrated experience in manufacturing progressive cavity pumps.
- C. Qualified suppliers shall have a minimum 5 years' experience in manufacturing progressive cavity pumps and a minimum 20 installations at equivalent applications. Supplier shall provide a list of names and dates of installations for verification by the engineer or Owner's Representative.
- D. Factory test each pump using water with a factory certified motor, the same size as that specified. Tests shall consist of checking each pump at its rated speed, head, capacity, efficiency, and brake horsepower; and at such other conditions of head and capacity to properly establish the performance curve. Submit copies of the performance curves to the Contractor for Engineer review prior to releasing the pumps to the Contractor. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading.
 1. Comply with Section 016600, Product Handling and Protection.
- B. Acceptance at Site.
 1. Inspect all equipment and materials against reviewed Shop Drawings at time of delivery.

2. Equipment and materials damaged or not meeting the requirements of the reviewed Shop Drawings shall be immediately returned for replacement or repair.

C. Storage and Protection

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the manufacturer's instructions.

1.8 WARRANTY

- A. Equipment manufacturer shall provide warranty for all parts and the motor for one (1) year following the date of substantial completion. Warranty shall be for the replacement of any and all parts at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Seepex Series BN
2. Moyno
3. Or approved equal.

- B. Manufacturers must currently have installations for the same liquids and of the same model pump unit, in service for a minimum of three years.

- C. Manufacturers not named in this specification must also provide a pre-submittal package to the engineer no less than 10 days prior to the bid date for approval. The pre-submittal package must include, at minimum, the following: dimensional drawing, performance curve, O&M manual, electrical/drive details, installation list (for the same liquids as specified) with minimum three contacts and phone numbers.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Identification

1. Location	- Adjacent to Digesters, as indicated on Drawings
2. Service	- Waste Activated Sludge from Digesters to Volute Press

3. Quantity - 2
 4. Pump Name - Sludge Feed Pump
- B. Operating Conditions: The work of this Section shall be suitable for long term operation under the following conditions.
1. Duty - Constant
 2. Drive - Variable speed
 3. Ambient environment - Indoors
 4. Fluid service - Waste activated sludge
 5. Percent of Solids - 0.75% to 2%
 6. Fluid temperature - Ambient
 7. Type of suction port - Flanged
- C. Performance Requirements:
1. Design flow capacity - 27- 87 gpm
 2. Discharge pump head - 40 ft
 3. Suction Lift Required - 12 ft
 4. Total Differential Head - 52 ft
 5. Maximum pump speed - 242 (rpm)
 6. Minimum motor size - 10 HP
 7. Net Positive Suction
Head Available(NPSH_A) - 15 ft
- D. Pump Dimensions:
1. Min size of suction - 4 flange (in)
 2. Min size of discharge - 5 flange (in)
 3. Suction and Discharge: - ANSI Standard 150 lb flange
 4. Maximum pump length - 8-ft including space required for disassembly
- E. Construction:

1.	Pump body with inspection port -	Cast iron, class 30 with flushing and drain port and hand hole drain connections on suction end
2.	Stator	-Buna- N shore durometer hardness of 70
3.	Rotor	- C45 Tool Steel - Duktal Coated (1250 Vickers hardness)
4.	Shaft	-Solid one-piece shaft through bearings and seal; same material as rotor
5.	Shaft Sleeve	-Type 316 stainless steel
6.	Bearings	-Ball and tapered roller bearings, minimum 60,000 hours L-10 life, grease-lubricated
7.	Joints	-Oil or grease-lubricated, pin-joint type universal joints of chrome alloy steel, completely sealed and grease-filled
8.	Connecting rod	-Same material as rotor, designed to maintain maximum angularity of 1.5 degrees
9.	Shaft seal	-Single internal mechanical seal
10.	Pump base	-Cast-iron or steel pan with drain, with factory-mounted pump and drive unit.
11.	Number of stages	-One (1)

F. Design

1. Rotor and Stator: Each pump shall be a one-stage design employing a convoluted helical rotor operating in a similarly convoluted stator. The convolutions shall be configured to form a cavity between the rotor and stator, which shall progress from the pump's inlet to discharge port with the operation of the rotor. The fit between the rotor and stator at the point of contact shall compress the stator material sufficiently to form a seal and to prevent leakage from the discharge back to the inlet end of the pumping chamber.
 - a. The stator shall be moulded in two halves and assembled with a Segment Retainer for positioning of the stator halves, and Adjusting Segments to seal the stator halves and adjust the stator clamping.
 - b. Flanged sealing sections shall be moulded integral to the stator segments preventing the metal stator reinforcement from contacting the pumped liquid.

- c. Gaskets or "O" rings may not be used to form this seal. Stators for sludge pumps shall have Buna elastomer.
 - d. The rotor shall be designed to fit directly into the coupling rod via a pin type connection for easy replacement or maintenance.
 - e. The sludge pump rotors shall be constructed of C45 tool steel. Additionally, the sludge pump rotors shall have a chromium nitride coating (Duktil) with a hardness of 1250 Vickers and a minimum thickness of (.010").
2. Rotor and Drive Train: The rotor drive train shall be warranted for three (3) years from acceptance and shall consist of the following:
- a. Each pump rotor shall be driven through a positively sealed and lubricated pin joint.
 - b. The pin joint shall have replaceable bushings, constructed of air-hardened tool steel of 57-60 HRc, in the rotor head and coupling rod.
 - c. The pin shall be constructed of high speed steel, air hardened to 60-65 HRc.
 - d. The joint shall be grease lubricated with a high temperature (450° F), PTFE filled synthetic grease, covered with Buna N sleeve and positively sealed with hose clamps constructed of 304 stainless steel.
 - e. A stainless steel shell shall cover the rotor side universal joint assembly to protect the elastomer sleeve from being damaged by tramp metals or glass. The universal joints shall carry a separate warranty of 10,000 operating hours. This warranty shall be unconditional in regards to damage or wear.
3. Casing: A 150-pound (ANSI B16.5) flanged connection shall be provided at both the inlet and discharge ports. Cast iron suction and discharge casings shall each be provided with a 3/8-inch (or larger) tap to permit installation of pressure instruments.
4. Bearing: Each pump shall be provided with oil lubricated thrust and radial bearings, located in the gearmotor, designed for all loads imposed by the specified service.
5. Shaft Sealing: Shaft shall be sealed using a single internal mechanical seal (Single, elastomer bellows Material code Q1Q1VGG). The shaft shall be solid through the sealing area, but of a two-part design which allows the rotating unit to be removed from the pump without disassembly of the gearmotor bearings. Seal materials shall be solid silicon carbide faces with 316 stainless steel metal parts and fluoroelastomers (FKM).

2.3 MOTOR AND CONTROL SYSTEM

A. Drive:

1. Conform to the provisions of National Electric Code.
2. Gear motors or gear reducers shall be designed in accordance with AGMA 6019-E (Class II). Unless otherwise noted, motors shall be energy-efficient, TEFC motors in accordance with Division 26 specifications, and shall be heavy duty, energy efficient, inverter duty, electric motor, suitable for 460-volt, 3- phase, 60 Hz power supply.
3. The gear reducer shall be sized for a minimum service factor of 1.5 and designed with a thrust load capability of 150 percent of the actual thrust load.
4. Pumps shall be equipped with variable frequency drives (VFDs). The VFDs shall be constant torque type as specified in Section 262923. The pump manufacturer shall be responsible for the provision of the fixed reduction between the motor and pump. The reduction ratio shall be that required to operate the pump at its maximum operating speed when the motor is operating at its nominal rated full speed in accordance with parameters listed in paragraph 2.2.

B. Control Panel:

1. General:
 - a. Common control panel shall be provided for the two pumps.
 - b. The Control Panel may either be supplied by the pump supplier, or by an approved panel builder hired directly by the Contractor.
 - c. The party supplying the panel shall provide system start-up services and warranty.
2. Enclosure:
 - a. Filtered, Gasketed, NEMA 1 SS enclosure sized to accommodate panel components and cooling fan.
 - b. Provide cooling calculations as part of shop drawings.
3. Motor Controllers:
 - a. Provide Variable Frequency Drives for the pumps, meeting the requirements of Specification Section 262913.
 - b. Provide output filter and field verify that voltage peaks at motor terminals do not exceed NEMA MG1 limits (the control panel shall be installed indoors, a significant distance away from the pump motors).
 - c. Each drive shall be provided with a front panel mounted HMI for local program modifications and manual control of output.

- d. Interface the Motor Thermal Cut-out switch to the VFD.
- 4. Pilot Devices:
 - a. H-O-A switch (one per pump)
 - b. Running Light
 - c. VFD Fault Light
 - d. Motor Overload Light
 - e. Alarm Reset Pushbutton
- 5. Miscellaneous:
 - a. Circuit Breaker or Motor Circuit Protector for each pump, with externally operable, lockable handle.
 - b. Control Power transformer
 - c. Control Relays, terminals, wireways, and all other miscellaneous components necessary for a complete and functional system.
- 6. Functional Description and Interface to the Press Control Panel:
 - a. Hand Mode:
 - 1) In Hand mode each pump shall be controlled from the respective VFD HMI.
 - b. Auto Mode:
 - 1) In Auto mode, each pump shall be controlled from the Press Control Panel
 - c. Interface to the Press Control Panel:
 - 1) Provide dry contact outputs for monitoring of the following:
 - a) H-O-A in Auto mode (for each pump)
 - b) VFD and Motor Alarm (for each pump)
 - c) VFD speed feedback (for each pump)
 - 2) Hardwire the following inputs from the Press Control Panel
 - a) Pump Run Signal (for each pump)
 - b) Pump Speed reference (for each pump)
 - 3) Refer to I/O schedule on the I&C sheets for additional information.

2.4 ACCESSORIES

- A. Run Dry Protection: The stator shall be fitted with a special sensor sleeve and thermistor sensor. A set-point controller shall also be provided and shall be installed by the contractor in the motor control center. The controller shall monitor the stator temperature and activate a shutdown and alarm sequence if the stator temperature reaches the adjustable limit on the controller. The controller shall include a manual local and remote reset function. Input to the controller shall be 1x115VAC/60 Hz.
- B. Over Pressure Protection: Each pump unit shall be supplied with a silicone-filled isolation ring with a dual mounted gauge and single point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans, and be constructed with a carbon steel body and fittings with a Buna sleeve. The switch shall be SPDT, NEMA 4.
- C. Data Plates: Attach stainless steel data plates to the pump, showing the manufacturer's name, pump size and type, serial number, capacity and head rating, and other pertinent data. Attach a special data plate to the pump frame listing identification of the frame and bearing numbers.
- D. Hardware: All machine bolts, nuts and cap screws shall be hex head. Hardware or parts requiring special tools or wrenches shall not be used.

2.5 SHOP FINISHING

- A. Protect all exposed ferrous metals with a minimum of one coat of shop primer. Apply an additional coat of machinery enamel to motors, pumps, gear boxes, and other similar equipment.
- B. All surfaces must be dry, clean, and free of rust, scale, oil and grease. Clean steel surfaces by pickling or blasting to a minimum of SSPC-SP6.
- C. Shop Preparation and priming shall be in accordance with the requirements of Section 09801, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment and accessories in accordance with reviewed Shop Drawings and manufacturer's instructions, as specified herein and shown on Contract Drawings.

- B. Furnish and set stainless steel anchor bolts with nuts and washers in accordance with the manufacturer's recommendations.
- C. All electrical equipment, conduit and wiring not indicated on the Drawings, but necessary to provide a complete operating system shall be provided at no additional cost to the Owner.
- D. Electrical Wiring: The external conduit and wiring required for power supply and control to electrical equipment supplied in this Section shall be furnished and installed in Division - 26, Electrical.
- E. Motor size: Any deviation in motor size must be approved by the Engineer. Any electrical equipment or wiring that must change to accommodate a different size motor will be at no additional cost to the Owner.
- F. The grade and amount of oil and grease shall be in accordance with the manufacturer's recommendations.
- G. Lubricate, adjust and leave in proper operating condition.

3.2 FIELD QUALITY CONTROL

- A. The manufacturer shall furnish the services of a qualified representative for a period of not less than one day to inspect and adjust the equipment furnished in this section. This qualified representative shall also conduct such tests as necessary to demonstrate satisfactory operation and to instruct the Owner's personnel in the care and operation of the equipment.
- B. The service representative of the Manufacture shall be present at the site for 1 work day (8 hours), to furnish the startup services. If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.
- C. For the purposes of this section, a work day is defined as an eight-hour period at the Site, excluding travel time.

3.3 TESTING

- A. After completion of installation, the pumps shall be completely tested to demonstrate compliance with operating requirements as specified.

3.4 DEMONSTRATION AND INSTRUCTIONS

- A. Provide the services of a qualified factory-trained manufacturer's representative to conduct training covering operation, mechanical maintenance and electrical requirements:

- 1. Classroom room training - 1 hour.
- 2. Hands-on training - 1 hour.

3.5 MAINTENANCE

- A. Comply with the requirements of Section 017823.

- B. Repair Parts and Maintenance Material:

- 1. Supply tools and a repair parts kit for the grinder furnished as recommended by the manufacturer.
- 2. Supply the following repair parts:
 - a. One (1) set of stator halves (only the rubber halves shall be replaced when worn out).
 - b. One (1) rotor.
 - c. One (1) set universal joint assemblies.
 - d. One set connecting rod joint assembly.
 - e. One (1) mechanical seal

END OF SECTION 432357

SECTION 462133 – SCREENING AND PRESS 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.
- B. Related Sections:
 - 1. Division 03 – Concrete
 - 2. Section 352016 – Sluice Gates and Slide Gates
 - 3. Division 26 – Electrical

1.2 SUMMARY

- A. Contractor shall furnish, install and place into satisfactory operating condition two (2) rotating, self-cleaning, perforated plate screens for removing floating, particulate and fibrous material and for conveying, washing, dewatering and compacting the screenings before discharging the material into bags, while water collected in the closed trough shall be discharged upstream of the screen; as shown on the drawings and described in the specifications.
- B. The perforated plate screen shall consist of a rotating cylindrical screen with an integral screw conveyor and screenings press. The Screen shall use a single drive for screening, conveying, dewatering and compressing the screening material. The screen shall have an inclination of 35 degrees.
- C. To minimize odors and nuisance, the conveyance, dewatering and compaction zones shall be completely enclosed.
- D. It is the intent of this specification that all equipment called for under this section shall be supplied by a single manufacturer.
- E. All work performed under this section shall be in accordance with all approved trade practices and manufacturer's recommendations.
- F. The contract drawings and specifications were prepared based on Rotamat Perforated Plate Screen, Model RPPS/1400/2 as manufactured by Huber Technology, and the Contractor shall base bid on this equipment.

Alternate equipment will be considered provided all conditions specified hereunder are met. Partial submission of the required information will be reasons for rejection. The following requirements shall be met and information requested must be submitted prior to the Contractor's bid proposal. SAVI Flo-Drum In-Channel Rotating Drum Screens, Model VSA 1200/2 as manufactured by Enviro-Care Company has been pre-approved and named as an alternate on the bid proposal form.

1. The alternate price shall be proposed in the proper location as provided in the bid proposal forms.
2. If engineering is required due to the alternate, the Contractor shall pay the Engineer for engineering service. The cost for the engineering re-design service shall be included in the net savings deduct amount quoted on the bid proposal form. It is the Contractor's responsibility to determine what design changes are required and include all related costs in this alternate bid proposal. Failure to do so does not relieve the Contractor from providing a complete and operable system as specified.
3. Alternate equipment other than that specified and shown will not be considered if not submitted to the Engineer for approval, prior to the Contractor's bid proposal.
4. Proposed Alternate to the specified equipment and material will be considered if the proposed alternate is superior or equal in construction and/or efficiency to that described in the specifications and the high quality has been demonstrated by at least five (5) years of continuous service in similar installations. Information and materials required by the Engineer to be submitted for review and consideration prior to the bid proposal are as follows:
 - a. Complete detailed list and description of proposed equipment.
 - b. Written details and drawings, specifications and design computations concerning the proposed equipment. Shop drawing quality submittals are not required.
 - c. Power requirement over the entire operating range.
 - d. Complete installation instruction of equipment and related parts
 - e. List of installations with names of the persons to be contacted and telephone numbers.
 - f. Information regarding proper operation and maintenance of the equipment, methods of maintenance and estimated frequency of such maintenance for the entire system. This information should be sufficiently detailed to allow the Engineer to determine maintenance costs of the system.
 - g. Electrical work as it pertains to the system

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- B. Manufacturer shall have a minimum of twenty (20) years' experience producing equipment substantially similar to that required and shall be able to submit documentation of at least ten (10) independent installations using the same size or larger equipment as detailed in the below. Each installation must have been in satisfactory operation for at least three (3) years.
- C. Manufacturer shall have established an ISO 9001 certified quality management system. Equipment suppliers not utilizing ISO 9001 facilities shall not be considered or approved for this project. Equipment supplier shall provide evidence of certification before being named as an acceptable manufacturer.
- D. Manufacturer shall have established an ISO 14001 certified environmental protection management system designed to monitor and help minimize the harmful effects on the environment caused by its manufacturing processes. Equipment suppliers not utilizing ISO 14001 facilities shall not be considered or approved for this project. Equipment supplier shall provide evidence of certification before being named as an acceptable manufacturer.
- E. Manufacturer shall provide screen, motors, gear reducers, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination, compatibility, and operation of the system. The manufacturer shall test-run the fully assembled machine in his factory before shipment.
- F. The entire unit shall be manufactured from AIR 304L stainless steel shapes.
- G. The entire unit shall be manufactured from AISI 304L stainless steel shapes. All components made of stainless steel shall be passivated by full submergence in a pickling bath for perfect surface finishing. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are also fabricated, in order to prevent contamination by foreign debris which can cause corrosion of stainless steel.
- H. All stainless steel parts of the unit shall be fully submerged into a pickling bath for at least 8 hours to remove welding spots and to protect the stainless steel against corrosion. Glass bead blast or chemically treated stainless steel shall not be allowed.
- I. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are also fabricated, in order to prevent contamination by foreign debris which can cause corrosion of stainless steel.

- J. Bolts, nuts and washers shall be selected from AISI 304L or 316L stainless steel such that they are anti-seizing.
- K. Fabrication shall be done in compliance with all applicable ASTM standards.
- L. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section equal to or greater than the parent metal. Butt welds shall fully penetrate to the interior surface and gas shielding to interior and exterior of the joint shall be provided.
- M. All welding is performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code, or equivalent.
- N. Electric motors, gear reducers, and other self-contained or enclosed components shall have an acrylic enamel finish.

1.4 PERFORMANCE REQUIREMENTS

A. Screen Design Summary

1. Number of screens	2
2. Nominal screen basket diameter	1200 mm
3. Average Flow (one screen)	0.25 MGD
4. Peak Flow (one screen)	1.0 MGD
5. Max. Flow (one screen)	0.75 MGD
6. Max. Hydraulic capacity per screen (clean water)	?? MGD
7. Channel Width	48"
8. Channel Depth	72"
9. Screen Opening	2 mm
10. Opening Type	Perforated Plate
11. Angle of Inclination	35 degrees
12. Discharge height from top of channel, inch	50"
13. Maximum headloss at peak flow	17.25"
14. Downstream water level	27"
15. Wash Water Requirement	51 gpm @ 75 psi
16. Location Rating	Class 1, Division 1

- B. The Screen shall be designed to handle the maximum flow with the maximum upstream and downstream liquid levels as specified above.
- C. The nominal bar spacing specified above shall be the size of the circular openings. Screen designs which define the bar spacing as the distance between a fixed bar element and a moving adjacent bar element are not acceptable. Screens using rotating rakes, screw flight mounted brushes, wedge wire, or traveling filter media are also not acceptable.
- D. The average perforation flow through velocity shall not exceed 3.3 ft/sec (1.0 m/sec) under any flow condition up to the maximum clean water flow specified above. The screen design shall minimize solids deposits in the channel.
- E. The screen shall be capable of processing spherical objects with a diameter of 3-1/8". Such objects shall be conveyed through the auger and shall be discharged with the screenings. The unit shall be capable of processing the screenings load specified above.
- F. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of EPA Publication SW-486.
- G. Operation of the rotating screen shall be automatically initiated at a preset high upstream liquid level. Screens which operate continuously or via timer only will not be acceptable. The rotating basket shall remove solids from the flow and deposit them into the concentric screw conveyor hopper using a spray bar and basket cleaning brush providing positive cleaning of the screen basket surface. The screenings shall be transported up the screw conveyor, through an integrated screening washing system, a compaction and dewatering zone and then shall be discharged into heavy duty screenings bags.
- H. All open spaces of the screen shall be positively cleaned via a spray bar and cleaning brush system. Screens using a rotating rake or only screw flights with brushes will not be acceptable.

1.5 SUBMITTALS

- A. The following information shall be submitted to the Engineer in accordance with Section 013323 – Shop Drawings, Product Data and Samples. Copies of all materials required to establish compliance with this Section. Submittals shall include the following:
- B. Product Data: Submit manufacturer's technical data and application instructions.
 - 1. Descriptive literature, brochures, catalogs, cut-sheets and other detailed descriptive material of the equipment.
 - 2. Motor characteristics and performance information.
 - 3. Gear reducer data including service factor, efficiency, torque rating, and materials.

4. Parts list including a list of recommended spare parts.
- C. Shop Drawings
 1. Manufacturer's installation drawings.
 2. Wiring and schematic diagrams.
- D. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.
- E. Equipment weights and lifting points.
- F. Recommendations for short and long term storage.
- G. A copy of the manufacturer's warranty
- H. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

1.6 SPARE PARTS

- A. The following Spare Parts shall be included and supplied together with the equipment:
 1. 1 set of basket cleaning brushes
 2. 1 complete bottom bearing assembly
 3. 1 Solenoid valve rebuild kit
 4. 1 polyurethane basket seal
 5. 5 Bagger Boxes with 295ft endless bags each
 6. 6 polyamide rollers

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Base Bid Manufacturers:
 1. Huber Technology, Rotamat Perforated Plate Screen, Model RPPS 1200/2
- B. Named Alternate:
 1. Enviro-Care Company, SAVI Flo-Drum In-Channel Rotating Drum Screen, Model VSA 1200/2

2.2 MATERIALS

- A. The entire unit shall be manufactured from AISI304L austenitic stainless steel shapes (rods, angles, and channels), pipes, and sheets.
- B. The entire equipment shall be manufactured in a stainless steel only factory to prevent contamination of the stainless steel with foreign contaminants.
- C. The equipment, after its fabrication, shall undergo a passivation (pickling) process to ensure maximum resistance to corrosion. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid to remove any residues that may be present on the material as a result of foiling, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Submergence insures complete coverage. Spray on chemical treatments and glass bead blasting are specifically not acceptable due to their inability to provide complete and uniform corrosion protection.

2.3 EQUIPMENT

- A. Screen
 - 1. The perforated plate screen shall be designed and built to withstand static and hydraulic forces exerted by the liquid to the screen. All structural and functional parts shall be sized for the loads encountered during the screening, conveying and pressing operations. All submerged components and all components of the rotary screen in contact with the screened solids shall be of stainless steel construction.
 - 2. The screen basket shall be of a cylindrical shape. The perforated plate shall be around the entire basket circumference. The perforated plate spacing shall be as specified in 1.4A. Bars or wedge wire will not be acceptable screen media.
 - 3. The basket diameter shall have a width as noted in 1.4A.
 - 4. The upper end of the basket shall incorporate a support ring which shall be machined and supported by three (3) guide rollers made of polyamide. The guide rollers shall be attached to an upper support plate. This plate shall match a flange that is attached to the augur tube to ensure proper alignment of the basket. A brush shall be clamped to the upper support plate sealing the gap between the rotating screen basket and the fixed upper support plate.

5. The lower support ring of the basket shall be connected to the shaft of the auger and be driven by a common drive with the auger. The basket shall be connected with a solid support arm at the lower end of the basket which is bolted to the auger shaft.
6. A seal plate shall be provided between the circular screen and the channel. The seal plate shall be one-piece fabricated of stainless steel plate. The sealing plate shall be of sufficient height to prevent bypassing of flow around the screen at the maximum screen hydraulic capacity. A polyurethane seal, affixed to the stationary face baffle and fold to the inside periphery of the rotating drum (hydrostatic pressure of the water inside the drum shall aid in the seal), shall be provided to ensure that there will be no bypass of unwanted solids through the screen. Screens using a brush or a combination of brush and a rubber seal attached to the backside of the baffle plate (hydrostatic pressure of water inside of drum counteracts against the seal) for sealing the gap between the fixed seal plate and the rotating screen basket shall not be allowed.
7. The screen shall be provided with a support stand allowing for easy removal of the screen basket from the channel for maintenance purposes. The support stand shall be fabricated from stainless steel Double-C-Channels having the minimum dimensions of 7 inches by 2.75 inches with a thickness of 0.125 inches.
8. The screen shall be provided with a stainless steel housing of four wall plates and a cover. The housing shall be made of 5/64-inch-thick stainless steel plate. The cover shall be made of 0.06-inch-thick plate. The cover shall be removable and shall be secured with turn-locks.

B. Cleaning Brushes

1. The screen basket shall rotate in one direction and pass through the topmost position where it is cleaned with a stainless steel high pressure spray bar and a stainless steel backed nylon brush with bristles that penetrate the depth of the perforated plate screen to ensure positive screenings removal. Brush bristles shall be high-strength nylon for superior life.
2. The brush shall be designed to ensure cleaning of the spaces to the full depth of the perforated plate. The cleaning brush shall be mounted upon a stainless steel holding device which keeps the brush in constant contact with the basket and shall be adjustable to allow for brush wear.
3. Another stainless steel backed nylon brush shall be attached to the rotating basket and positioned to make contact with the screening trough to sweep material caught on the edges of the trough

C. Screenings Conveyor and Screening Wash-Press

1. The auger tube shall have a diameter of 10.75 inches. The auger tube shall incorporate two (2) anti-rotation bars which shall be welded to the inside of the transport tube along the longitudinal axis. The screw shall not be in contact with the anti-rotation bars during normal operation, the screw shaft shall be supported by a Teflon® lined bronze slide bearing at the bottom and the gear box at the top.
2. A support flange with a minimum thickness of 0.6 inches shall be welded to the screenings transport tube. The screen basket rollers and the screenings collection hopper shall be attached to this plate.
3. A gear box support flange with a minimum thickness of 0.6 inches shall be welded to the screenings transport tube. The screen basket rollers and the screenings collection hopper shall be attached to this plate
4. A shafted auger screw that is entirely made of stainless steel shall be provided to transport and dewater the screened material. A shaft-less screw shall not be acceptable. Screw flights shall be of decreasing pitch approaching the compaction zone to provide a mechanical compressing action on the screenings material. The shaft shall have a diameter of 3.5 inches and shall have flights with a minimum thickness of 0.2 inches in the transport zone and 0.4 inches in the compaction zone. A replaceable flight section with an angle of about 120 degrees that is bolted to the shaft shall be provided at the bottom of the shaft where the wear is highest.
5. A compaction zone shall be an integral part of the screenings screw conveyor and transport tube design. The compaction zone shall be designed to form a screenings plug of material and to return water released from the screened material back to the wastewater channel/pump sump through circular holes that are machined into the screenings transport tube.
6. The auger shaft shall be fitted with an upper and a lower solid stub. Stubs and screw shaft shall be accurately machined and shrink-fitted.
7. The lower end of the screenings conveyor shall be supported by a sealed, self-lubricated, Teflon® lined bronze slide bearing. This bearing shall not take any thrust load from the screw conveyor. Lower ball or roller bearings, or bearings requiring lubrication, shall not be acceptable.
8. The lower bearing shaft and arm shall be designed to minimize material wrapping around the shaft. A seal plate shall be furnished to mate between the stationary lower bearing support and the rotating arm to prevent material intrusion into the bearing seals.
9. A compaction zone shall be provided as an integral part of the screw conveyor and tube. The compaction zone shall be designed to form a plug of screenings material and to return water released from the screened material back to the channel through

0.2 inch (5 mm) diameter perforations that are machined into the screenings transport tube in a square configuration.

10. The compaction zone shall be provided with split glass fiber reinforced housing, furnished with gaskets and bolts, and easily removable for access. Designs requiring removal of the drive assembly, discharge head, or screw conveyor to gain access to the compaction zone will not be acceptable. The housing shall be provided with a drain connection at its lowest point and a clamped flexible PVC hose for drain water whose other end is connected to a connection through the screen basket's upper support flange to return the drain water into the screen basket. The plastic housing shall also be provided with a 1-inch flush connection.

D. Drive

1. The basket mechanism and transport screw shall be driven by a shaft mounted geared motor. The geared motor shall have a minimum service factor of 1.0. The motor shall be provided with thermostats to provide thermal overload protection in addition to current overload protection.
2. The gear reducer shall be bolted to a machined flange welded to the upper end of the transport tube.
3. The gear reducer shall be driven by a 3 phase, 60 Hertz, 480-volt, Class 1, Division 1, Group D inverter-duty, totally-enclosed, fan-cooled motor which leads to a conduit box for outdoor operation. The motor rating shall be a minimum of 2.0 hp.

E. Spray Wash System

1. The spray wash system shall be enclosed such that spray water, aerosols or leakage do not contaminate the operating floor.
2. The screen shall be designed for a water supply of 39 gpm and shall be provided with wash water distribution manifold with a single 1.5-inch point for connecting to the treatment plants final effluent water supply.
3. An automatic spray wash system shall be provided for cleaning of the screen basket and shall be constructed of minimum 1-inch diameter piping and minimum 1 inch diameter flexible reinforced PVC hose. The spray wash systems shall be operated only while the screen basket is rotating. The spray wash system shall include a single 1-inch solenoid valve for flow control. Min. pressure to the spray wash shall be 75 psi (5 bar).
4. The screen shall incorporate a screenings washing system (IRGA) consisting of two washing points, one being in the rising tube of the screen and the second being in the screenings collection hopper. The screenings wash zone in the conveyor tube shall be provided with three nozzles located equidistant around the circumference

to maximize the washing performance. A lower wash system shall be located above the open top of the hopper and shall utilize a spray bar with a minimum of 2 spray nozzles. The screenings washing system shall include a single 1 inch solenoid valve for flow control.

5. The screen compaction zone shall be provided with a wash nozzle designed to flush the entire interior surface of compaction zone housing to ensure no debris buildup can occur. The compaction zone flushing system shall include a single 1 inch solenoid valve for flow control.
6. The solenoid valves shall be operated by the programmable logical controller. Individual manual operation of each solenoid shall also be possible from the control panel.
7. The solenoid valves shall be minimum 1-inch diameter, brass body, 2-way, and designed for 110 VAC with an explosion-proof rating. Solenoid valves shall be normally closed and rated for up to 100 psig.
8. A brass body Y-strainer shall be provided for the incoming plant water supply.

F. Bagger

1. A Paxxo Longofill continuous bagging system shall be provided to abate odors and to seal dewatered screenings to prevent any direct contact. The discharge bagging system shall provide a clean, odor-free means of collecting and containing the material discharged from the screenings equipment.
2. The bagging system components shall be attached to the screenings discharge. An accordion-folded plastic Paxxo Longopac cassette bag shall be fitted to the end of the bagging system and will collect any discharged material. The end of the cassette bag will be tied in a knot. When the operator decides that the cassette bag is full, the cassette bag shall be cut and the exposed ends tied in knots.
3. A Longofill stainless steel adapter flange and a Paxxo Longofill ABS plastic cassette bag holder shall be utilized to mount for the screenings discharge. The adapter flange shall be fitted to the discharge chute such that it is positioned as close to horizontal as possible. The plastic holder shall be attached to the stainless steel adapter and shall hold the continuous cassette bag.
4. The adapter flange shall be stainless steel. The holder shall be of ABS plastic and shall consist of two parts, a tube and brim, which shall be held together by a stainless steel ring. The cassette bag shall be 295 ft (90m) long, non-porous, three-ply, co-extruded polyethylene with a thickness not to exceed 1.5 mils and a dart drop of not less than 1.65 lbs (750 g).

G. Anchor Bolts

1. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be stainless steel. Anchor bolts shall be wedge or epoxy type.
2. Bolts, nuts and washers shall be selected from AISI 304L stainless steel such that they are anti-seizing.
3. Anchor bolts shall be set by the contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

H. Control System

1. All controls necessary for the fully automatic operation of the screen shall be provided, including a NEMA 4X main control panel, and a NEMA 7 local control station.
2. The electrical control system shall provide for automatic control of the screen via a high liquid level using a Milltronics Pointek ultrasonic level sensor in combination with an adjustable timer.
3. The control system shall be designed such that the cleaning characteristics of the screen and wash system can be changed via the programmable controller. Systems which do not offer this feature will not be acceptable for this project.
4. Main control panel shall be suitable for outdoor, wall-mounting. Enclosure shall be NEMA 4X Stainless Steel with continuous hinge and lockable door latch, and shall include the following:
 - a. Door-interlocked and fused disconnect
 - b. 600 VAC terminal block
 - c. VFD and Circuit Breaker Branch Circuit Protection for screen motor
 - d. Control power transformer with 120 VAC transient voltage surge compressor (TV SC) and fused primary and secondary
 - e. Programmable logic controller (PLC), Allen Bradley Micrologix 1400 series with Ethernet/IP communication for integration into the SCADA system
 - f. Operator Interface (01U), Allen Bradley PanelView C400
 - g. Pilot lights for:
 - 1) Control power on (White)
 - 2) Screen running (Green)
 - 3) Screen high level (Amber)

- 4) Screen fault (Red)

- h. E-stop push button (Red)
- i. Screen reset push button (Black)
- j. Door mounted elapsed time meters for the following:
 - 1) Screen drive
- k. Digital inputs for the following:
 - 1) Machine start water level
 - 2) Maximum water level
 - 3) Eight spare inputs, for monitoring of channel gate statuses.
- l. Remote dry contact outputs for the following:
 - 1) Screen Running
 - 2) Screen Fault
 - 3) Screen E-stop
 - 4) Screen High Level
 - 5) One spare output
- m. Flashing alarm light and alarm horn with silencer-reset button
- n. Plastic Nameplates

- 5. A local operator station shall be provided, and shall be suitable for wall-mounting. Enclosure shall be NEMA 7 cast Aluminum, and shall include the following:
 - a. "Hand-Off-Auto" selector switches for the following:
 - 1) Screen drive
 - b. Screen 'Forward-Off-Reverse'
 - 1) Screen drive
 - c. Spray wash pushbuttons (Push-to-Test):
 - 1) Spray bar
 - 2) Screenings washing system (IRGA)

- 3) Compaction zone flushing
- d. E-stop pushbutton (Red)

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUALS

- A. Prior to the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions and a complete parts list and recommended spare parts list. The O & M manuals shall be in compliance with the General Requirements.

3.2 DELIVERY, STORAGE AND HANDLING OF EQUIPMENT

- A. All equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.
- B. The Contractor shall be responsible for unloading of the machinery and shall have equipment on-site available at the time of delivery permitting proper hoisting of the equipment.

3.3 FIELD PREPARATIONS AND PAINTING

- A. Contractor shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.
- B. Contractor shall supply paint for field touch-up and field painting.
- C. Contractor shall coat all stainless steel bolts and nut threads with a non-seizing compound prior to final assembly.

3.4 INSTALLATION, START-UP AND OPERATOR TRAINING

- A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of significant deviations.
- B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the manufacturer's recommendations

- C. Manufacturer shall furnish the services of a factory-trained Service Engineer for three (3) trips including six (6) days to inspect the installation, carry-out the equipment start-up procedures, and provide training to the operators in how to effectively operate and maintain the equipment.
1. Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the Service Engineer present.
 2. The Service Engineer shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.
 3. The Service Engineer shall make all necessary adjustments and settings to the controls, verify the measurement relay setting and the initial water level setting for the screen.
 4. The Service Engineer shall demonstrate proper operation of screen. The screen shall operate automatically based on the water level.
 5. The Service Engineer shall provide classroom and hands-on field training on the operation and maintenance of the equipment to operator personnel. These instructions shall include the use of slides, videos, literature, and oral presentations.
- D. Manufacturer shall state field service rates for a Service Engineer to Owner and Contractor. In the event that the field service time required by this section should not be sufficient to properly place the equipment into operation, and the requirement for additional time is beyond the manufacturer's responsibility, additional time shall be purchased by Contractor to correct deficiencies in installation, equipment, or material without additional cost to Owner.

END OF SECTION 462133

SECTION 465353.01 – SEQUENCING BATCH REACTOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 1 Specification sections, apply to work of this section.
- B. Standard References:
 - 1. American National Standards Institute, ANSI.
 - 2. National Electric Code, NEC.
 - 3. NEMA, Standards of National Electrical Manufacturers Association, NEMA.
 - 4. Occupational Safety and Health Act, OSHA.
 - 5. American Society for Testing and Materials, ASTM.
 - 6. American Iron and Steel Institute, AISI.
 - 7. American Gear Manufacturer's Association, AGMA.
 - 8. Institute of Electrical and Electronic Engineers, IEEE.
 - 9. Standards of the Hydraulic Institute.
 - 10. American Institute of Steel Construction, AISC.
 - 11. American Society of Civil Engineers, ASCE.
 - 12. American Welding Society, AWS.
 - 13. Steel Structures painting Council, SSPC.

1.2 SUMMARY

- A. The Contractor shall furnish all labor, materials, tools and equipment complete with all accessories and appurtenances required for a complete wastewater treatment plant as shown on the Contract Drawings and as specified herein.
- B. No product substitutions shall be allowed. The equipment to be furnished hereunder shall be an ICEAS[®], referred as SBR Treatment System, as manufactured by Sanitaire (Xylem).

- C. Furnish, deliver, and install a new and complete ICEAS® Treatment System, also referred to as the Sequencing Batch Reactor (SBR) system.
- D. The Intermittent Cycle Extended Aeration System (ICEAS®) shall include furnishing and installing the necessary equipment and controls to provide an operating treatment system complete with air diffusion equipment, decant mechanisms, blower systems, air control valves, waste sludge pumps, instrumentation, control panel, and MCC. The system supplier shall provide installation and start-up assistance training, and guarantee the process performance.
- E. It is the intent of these specifications that a single manufacturer-supplier, regularly engaged in the design, manufacture, assembly and production of sequential batch reactor systems of the type specified, shall have complete responsibility for the final design, furnishing, coordination, assembly, and installation supervision of all components in the Sequential Batch Reactor system.
- F. Working drawings, including arrangement and erection drawings of the equipment and control equipment; schematic control diagrams, electrical connection diagrams, and complete description of the control systems; and equipment operating characteristics shall all be furnished.

1.3 DESCRIPTION

- A. The system shall incorporate continuous activated sludge technology with intermittent systems operation. The system shall use a single reactor in which the activated sludge is alternately aerated and/or mixed over a number of pre-determined cycles. Solids liquid separation shall occur during a settling phase of the cycle. After the settling phase, treated effluent shall be decanted or withdrawn from the liquid surface. Flow to the vessel is not interrupted at any time.
- B. The functions of flow equalization, biological oxidation, nitrification, sedimentation and aerobic sludge stabilization shall all be carried out in a single reactor. Systems that require reactor bypassing during the settle and/or decant phases shall not be acceptable.
- C. Influent Wastewater Characteristics

Design Flow:		
Average Design Day Flow (ADDF)	0.250	MGD
Maximum Daily Flow (MDF)	0.500	MGD
Max. 4-Hour Cycle Flow	0.750	MGD

Max. 3-Hour Cycle Flow	1.000	MGD
BOD ₅	250	lb/day
TSS	250	lb/day
NH ₃ -N	50	lb/day
TP	8	lb/day
Temperature Range (Water)	10-20	°C
Temperature Range (Air)	20-90	°F
Site Elevation	900	ft
pH range	6.5-8.5	SU

D. Effluent Quality Requirements:

- The following effluent limits shall be on a 30-day arithmetic average:

BOD ₅	10	mg/L
Total Suspended Solids	10	mg/L
Ammonia NH ₃ -N	1.0	mg/L

E. ICEAS[®] Process Design

- The ICEAS[®] process shall be designed using the following parameters:

F/M Ratio	0.051	lb BOD/lb MLSS-day
SVI (After 60 Minutes)	150	ml/g
Cycle Time		
Normal	4	hour cycles/day
Storm-1	3	hour cycles/day
Storm-2	2	hour cycles/day
Storm-3	1.5	hour cycles/day
Decant Time		
Normal	72	min

Storm-1	45	min
Storm-2	30	min
Storm-3	45	min
Waste Sludge Produced (Approx.)	386	lb/day/basin
MLSS at Bottom Water Level	4,653	mg/L

2. The ICEAS® has been configured as follows:

Number of Basins	2	-
Width/Basin	21	ft
Length/Basin	59	ft
Water Depth at Top Water Level	18	ft
Water Depth at Bottom Water Level	14.6	ft

3. The dual tank design provides the ability to operate with one basin out of service, while maintaining F/M ratios and cell residence time within the endogenous respiratory phase of the biomass. This capability is useful for short time periods such as during basin and equipment maintenance.
4. Equally divided influent shall be continuously and simultaneously received by all basins of the system at all times, irrespective of the sequence of operation of the treatment system. The system shall be designed so that the basin configuration prevents short circuiting of the influent during the decant sequence. A portion of the ICEAS® basin reactor shall contain a discrete pre-react zone formed by a baffled wall. This zone shall have an anoxic environment during settle and decant phases.

1.4 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- B. All work performed under this section shall be in accordance with all approved trade practices and manufacturer's recommendations.

- C. The equipment manufacturers listed shall have a minimum of ten (10) years of experience of producing the specified equipment and shall be able to show evidence of at least ten (10) installations in satisfactory operation for at least five (5) years in the United States.
- D. The equipment furnished shall be fabricated, assembled, installed and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer. The equipment manufacturer shall, in addition to the Contractor, assume the responsibility for proper installation and functioning of the equipment.
- E. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work. All equipment shall perform as specified and accessories shall be provided as required for satisfactory operation.

1.5 SUBMITTALS

- A. The Contractor shall submit manufacturer's technical data and application instruction in accordance with the General and Supplementary Conditions and Division 1 Specifications and any additional information listed herein.
- B. Product Data: Submit manufacturer's technical data and application instructions.
- C. Shop Drawings: Submit required copies of manufacturer's literature, dimensional drawings, wiring diagrams, motor data, performance data, materials of construction, a description of the process design (Operational Description), a description of the control system software logic (Functional Design Specification), and any other information necessary to determine compliance of the equipment to the specification and project requirements.
 - 1. Highlight project-specific model numbers and options in equipment data sheets.
 - 2. Submittal drawings showing plan, elevation and cross sections of the equipment.
 - 3. Component details of the aeration equipment showing diffusers, diffuser holders, gaskets, retainer rings, supports, threaded union and/or flanged joints and a purge system.
 - 4. Materials and Manufacturing specifications.
- D. Aeration System submittal information to include:
 - 1. Equipment data sheets
 - 2. Performance data including oxygen transfer calculations

3. Certified SOTE curves from previous test runs on equivalent system shop transfer testing.
 4. Headloss calculations and pressure requirements.
 5. Customer contact list with telephone numbers (minimum of 10 contacts from similar size facilities).
- E. Operation and maintenance manual with installation instructions. Submit after approval of equipment and prior to shipment.
- F. Process Performance Guarantee

1.6 WARRANTY

- A. Manufacturer shall guarantee all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the date first placed in service or eighteen (18) months after delivery whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
1. SBR Treatment System shall be an ICEAS[®], as manufactured by Sanitaire (Xylem).

2.2 POSITIVE DISPLACEMENT BLOWERS

- A. Provide all labor, material and equipment to furnish and install the positive displacement blower systems as specified herein and detailed on the drawings for the SBR basins. The blower systems shall be designed for the following operating characteristics:

	Units	SBR	SHT
Quantity	EA	2	2
Air Flow ¹	scfm	230	190
Discharge Pressure	psig	8.3	8.8
Motor Shaft Power	hp	20	15
Motor Control		Constant	Constant

Supply Power	-	460 / 3 ph / 60Hz

1. Standard Conditions: Air Flow measured at 14.7 psia (1 bar), 68°F (20°C) and 36% relative humidity.
 2. Site Specific Conditions: Site Elevation 900 or 14.21 psi, 100°F and 90% relative humidity.
 3. Noise level: Enclosure shall reduce the sound levels by 15-20 dBa and shall be sufficient to meet the 75 dBa attenuation requirement at one (1) meter from any exterior surface of the enclosure.
- B. Blower and accessories shall be furnished as a complete assembled package and must include all interconnecting piping, instrumentation and supports needed to ship the assembly as a complete unit.
1. Each blower package shall include the following main components:
 - a. Positive displacement blower with sound-proof enclosure
 - b. Motor with slide base
 - c. V-Belt drive
 - d. Drive guard
 - e. Common elevated structural steel base
 - f. Vibration isolator pads
 - g. Spare parts
 - h. Motor Over-temperature Switch
 - i. The motor controller for the constant speed blowers shall be equipped with full voltage non-reversing starter.
 - j. The spare unit blower shall be equipped with Variable Frequency Drive (VFD).
 2. Accessories: Each blower shall be furnished with the following accessory items:
 - a. Sound enclosure
 - b. Inlet and outlet flexible connectors (expansion joints)
 - c. Intake Filter
 - d. Inlet Silencer

- e. Discharge silencers
- f. Pressure Relief Valves
- g. Check Valve
- h. Discharge Butterfly Valve
- i. Vibration Isolator Pads
- j. Inlet Vacuum Gauge
- k. Discharge Pressure Gauge
- l. Discharge Temperature gauge
- m. Filter differential pressure gauge
- n. High temperature shut-down switch

C. Guarantee and Warranty

- 1. The manufacturer shall warrant the bare blowers being supplied against all defects in workmanship and materials for a period of twenty-four (24) months from date of startup, not to exceed thirty (30) months from the date of shipment from the manufacturer of the blowers.

D. Blower Construction

- 1. General
 - a. Each blower shall be of the horizontal, rotary, positive displacement type. Each assembly shall be rugged in construction and of such design that it may be disassembled and inspected without disturbing the inlet or discharge piping.
 - b. Blowers shall be V-belt driven by a motor.
- 2. The casing shall be made of high strength, close grained, cast iron, and shall be adequately ribbed to prevent casing deflection and facilitate cooling. Casing shall be of EN GG 200 cast iron. Inlet and discharge ports shall be flanged.
- 3. Rotors:
 - a. The rotors shall be a tri-lobe design in order to minimize pulsation and noise.
 - b. Each rotor and shaft shall be precision machined out of a one-piece casting made of CN45 forged steel.

- c. The rotor assemblies shall be statically and dynamically balanced to ISO standard Grade G 6.3.
 - d. The rotor must be solid or closed-end. The rotors shall operate without rubbing, liquid seals or lubrication in the air chamber.
 - e. The rotors shall have an integral sealing strip for improved efficiency.
- 4. Cover Plates
 - a. The gear-end and drive-end cover plates shall be high strength, close grained, cast iron made of EN GG 200 cast iron. Aluminum cover plates shall not be allowed.
 - b. The cover plates shall have a precision machined sealing face.
 - c. The drive-end cover plate shall include at least two precision machined holes to allow for the use of fitting bolts to accurately align the opening for the input shaft seal.
- 5. Bearings
 - a. The bearing maximum speeds must be at least two times the maximum recommended blower speed.
 - b. All bearings shall be anti-friction type rated by AFBMA standards to have a B10 life of 40,000 hours at design speed and maximum radial and thrust load conditions. Bearing life is AT LEAST 100,000hrs at design conditions
- 6. Timing Gears: The rotor timing gears shall be precision machined and ground from alloy steel made from case hardened 16 MnCr5 material. The timing gear set shall be taper-mounted on the rotors. Keyed, hub mounted, taper-pinned, or splined shaft timing gear mounting designs are not acceptable.
- 7. Lubrication:
 - a. Both the gear end and the drive end of the blowers shall be oil splash lubricated via a disc slinger for minimal maintenance and long service life.
 - b. The lubrication design shall ensure adequate lubrication of the timing gears and bearings.
 - c. The drive-end and gear-end oil chambers must not be interconnected and each oil chamber shall have a domed design sight glass to allow visual inspection of oil level and oil condition, viewable from the front of the blower.
 - d. Blower to be factory filled with a synthetic lubricating fluid that is rated for the design conditions specified.

8. Rotor Seal Assembly: Each rotor shall include one labyrinth seal assembly on each end, four assemblies in total per blower. Each seal assembly shall consist of the following:
 - a. Oil splash guard ring.
 - b. Shaft guide wear sleeve with vent holes located between the dual air and oil ring seals. Wear sleeve shall protect the blower casing.
 - c. Four piston ring type labyrinth seals made from heat treated cast iron. Two seals located on the air side and two seals located on the oil side of the grooved rotor sleeve.
 - d. Grooved rotor sleeve which will protect the rotor shaft and be used to hold the four piston ring seals.
9. Input Shaft Seal Assembly:
 - a. The input drive shaft seal shall be a high temperature radial lip type seal made from Viton elastomer. The seal shall prevent oil leakage from where the input shaft goes thru the drive end cover.
 - b. The seal design shall incorporate a replaceable wear sleeve on the input drive shaft. The sleeve exterior to be tungsten carbide coated to reduce friction and wear.
 - c. The input shaft seal design must allow for the lip seal and the shaft sleeve to be replaced without removing the drive end cover plate.
10. Base: The blower base frame with integrated discharge silencer shall be designed for the frequency range of the blower, shall be provided to reduce the noise of the blower system as specified.
 - a. The blower base shall incorporate the pivoting motor swing base and tensioning assembly to insure proper alignment of the drive assembly.
 - b. Belt guards shall be provided which completely enclose the V-belts and sheaves. The guards shall be easily removable so that belts may be conveniently serviced.
 - c. All required anchor bolts and sleeves shall be ASTM A 36 steel. Contractor shall supply recommended by the manufacturer anchor bolts.
 - d. Baseplates shall be grouted in place as required by conditions of installation with a non-shrink grout equal to Five Star Grout, Master Builders Embeco 636 Grout, or equal. Minimum grout thickness shall be 1-1/2 in. or as recommended by the manufacturer.

11. Drive System: Each blower shall be driven by a multiple V-belt drive system assembly consisting of sheaves, quick detachable bushings, V-belts, and sliding motor base. Provide drive assembly with a 1.4 service factor based on motor nameplate horsepower. A two-part OSHA approved drive guard shall be provided for each blower.

a. Motor: Each blower shall be equipped with an electric motor designed, manufactured, and tested in accordance with the latest revised edition of NEMA MG-1. The motor shall be a squirrel-cage induction type, single-speed, horizontally mounted motor conforming to the following:

- 1) Synchronous speed: 1800 RPM
- 2) Insulation: Class B with Class F insulation or better
- 3) Enclosure: TEFC or ODP
- 4) Service factor: 1.15
- 5) Duty cycle: Continuous
- 6) Ambient temperature rating: 40°C
- 7) Bearing lubrication: Manufacturer's standard
- 8) Bearing life: 50,000 hours rating life as defined by AFBMA Standards
- 9) High efficiency design with nominal full load efficiency of 90% minimum.
- 10) Motor windings shall have embedded, normally closed thermal switch that will open upon excessive temperature.

12. Oil Drains

- a. An oil drain from the blower drive-end and gear-end lubricating oil sumps shall be separately piped to the front of the blower base with flexible tubing. Common fill and drain shall not be allowed.
- b. Each oil drain shall include a drain valve installed for ease of maintenance. The drain valves shall be 90° stainless steel ball valves and include a fully retained gasketed threaded cap to prevent accidental discharge of the blower lubricant.

13. Spare Parts: The equipment supplier shall deliver the following spare parts for each blower size:

- a. Lubrication for first year of operation

- b. One (1) set of V-belts of each size
- c. One (1) filter element for each size air intake filter
- d. All of the above parts shall be provided as spare parts and shall be packaged for potential long-term dry storage.

14. Installation, Startup and Training:

- a. The blower manufacturer will furnish services of a factory-based engineer for one (1) eight (8) hour day to check the blower installation, make any field adjustments necessary to insure proper mechanical operation, and instruct plant operations personnel on equipment supplied.
- b. The blower manufacturer shall submit a written report for record certifying that equipment has been satisfactorily installed and lubricated. The report shall also certify that training has been provided for operation and maintenance of the blower equipment.
- c. Factory testing: Each blower stage shall be factory tested in accordance with ISO 1217, Annex B performance test to verify flow and brake horsepower at blower maximum conditions. Each blower system provided by the manufacturer shall be guaranteed to provide performance to ISO 1217.

15. Acceptable Manufacturers:

- a. Aerzen PD Blower.

2.3 AIR CONTROL VALVES

- A. The SBR supplier to furnish the following motor operated air flow control valves to control aeration in the SBR basins.

Valve Location	SBR
Valve Quantity	2
Valve Diameter	4
Actuator Power Supply	120/1/60
Actuator Type	Open/Close

B. Valves Construction

- 1. The valves shall be butterfly valves, wafer body style, EPDM-seat, tight-closing type for installation between two (2) ANSI Class 125/150 standard flanges.

2. The valves shall be rated at 50 psi (345 kPa) and provide drop tight shutoff at differentials up to 50 psi.
3. Valve bodies shall be cast iron (ASTM A126, Class B) and have two flange bolt guides to center the body in the pipeline. Valves shall be provided with power actuators.
4. The seat shall be tongue-and-groove design and act as a body liner to prevent flow from contacting the body casting. The seat shall also provide a positive seal without use of flange gaskets. Seats shall be of EPDM suitable for use with compressed air and shall be field replaceable.
5. The disc shall be aluminum bronze (ASTM B148-954). The disc-to-shaft connections shall be direct drive double "D" design requiring no disc screws or pins to connect shaft to disc. Outside diameter of disc shall be designed that when opened, it will not interfere with adjacent piping.
6. Shafts shall be one piece and shall be 416 stainless steel (ASTM A582 Type 416). Shafts shall be finish ground to minimize bearing and shaft seal wear. Shaft seals shall be provided to prevent leakage and to protect bearings from internal or external corrosion.
7. Valves shall be furnished with self-adjusting stem seal and non-corrosive Acetal bushings for smooth, low torque operation.

C. Electric Motor Actuators

1. All electric actuators shall conform to the requirements of AWWA Standard C-540.
2. Power actuated valves shall be furnished with electric motor actuators. The valve actuators are to be sized for design pressure with flow in reverse direction plus a 1.5 safety factor. The actuators shall include, geared travel limit switches, torque limit switches, manual handwheel, condensation heater, terminals for motor power and controls and drive nut.
3. The motor shall be specifically designed for actuator service. The motor will be of the induction type with class F insulation and protected by means of thermal switches imbedded in the motor windings. Motor enclosure will be totally enclosed, non-ventilated.
4. The entire actuator enclosure should be NEMA 4 watertight.
5. Travel limit switches will be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions.
6. Mechanical dial position indicator will be furnished on all valves.

7. The motor shall have an operating speed adjustment.

D. Acceptable Manufacturers

1. Valves shall be Bray Series 30 Resilient Seated Butterfly or approved equal.
2. Actuators shall be AUMA model SG or approved equal.

2.4 FINE BUBBLE AERATION

A. Furnish all materials, equipment, services, and testing for the fine bubble aeration system.

B. Equipment Components Included

1. Stainless steel droplegs, supports, and anchors.
2. PVC manifolds, air distributors, diffuser holders, and retainer rings
3. Bolts, nuts and gaskets for aeration system flange connections.
4. Air distributor purge systems.
5. Membrane disc diffusers with integral O-ring gaskets.

C. System Design and Performance:

1. Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20°C and zero dissolved oxygen at the specified submergence, air rate and pressure.

Tank	Units	SBR	SHT
Std. O ₂ Transfer Rate (SOTR)	lbsO ₂ /hr	137	1,198
Volumetric Air Rate	SCFM	230	190
Operating Pressure at Top of Dropleg	psig	8.3	8.8
Diffuser Submergence (@ AVG SWD)	ft		
#Diffusers/Tank	each	150	119

2. Design air distributors with centerline spacing not to exceed 4 feet to maximize oxygen transfer efficiency and mixing efficiency and to minimize solids deposition between air distributors.

D. Materials, Fabrication and Finishing

1. Stainless Steel – Pipe, Fittings and Supports:
 - a. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240, 554, 774, 778.
 - b. Fabricate non-welded parts and flanges from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.
 - c. Welds & Welding Procedure: Weld in the factory using latest standards according to AWS. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.
 - d. Corrosion Protection and Finishing clean all welded stainless steel surfaces and welds after fabrication by using the following procedure: Pre-clean outside and finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.
2. Natural Rubber: Furnish all fixed and expansion joint O-ring gaskets of natural rubber/SBR with a Shore A durometer of 45 ± 5 .
3. Polyvinyl Chloride (PVC) Pipe and Fittings:
 - a. Produce all PVC pipe and fittings from PVC compound with a minimum tensile strength of 7000 psi.
 - b. Provide lower drop pipe, manifold and air distributors as follows:

<u>Diameter</u>	<u>Wall Thickness</u>	<u>ASTM</u>
4 inch	SDR 33.5	D3915, 3034
6 inch & larger	Schedule 40	D1784, 1785, 2466
 - c. Factory solvent weld all PVC joints. Field solvent welding will NOT be permitted.
4. EPDM Membrane Diffusers and Gaskets:
 - a. Manufacture circular membrane diffuser discs with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (i.e. plasticized PVC or polyurethane) are not acceptable.
 - b. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.

E. Fine Bubble Aeration System Components:

1. Droplegs: Provide a stainless steel dropleg from the air main connection to the dropleg connection on the manifold.
2. Manifolds: Provide PVC manifolds for connections to the air distribution headers. Fabricate manifolds with 4-inch diameter fixed threaded union positive locking anti rotational or flanged joints for connection to the air distributors.
3. Air Distributors and Diffuser Holders: Provide 4-inch diameter air distributors perpendicular to the air manifold.
 - a. Fabricate distributors with single diffuser holders solvent welded to the crown of the air distributor for complete air seal and strength.
 - b. Provide 4-inch diameter threaded removable end caps complete with gasket, threaded coupling and end plate for clean out at the end of each distributor.
4. Air Distributor and Manifold Connection Joints:
 - a. Join air distributor sections with positive locking anti rotational fixed threaded union or flange type joints for all submerged header joints to prevent blow apart and rotation.
 - b. Design flanged joints with a 125 lb drilling angle, face ring, follower flange and stainless-steel hardware.
5. Supports: Provide each section of manifold and air distributor with a minimum of two (2) supports.
 - a. Limit maximum support spacing to 8 feet.
 - b. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125°F.
6. Diffuser Assemblies: Furnish diffuser assemblies including diffuser, diffuser gasket, holder, retaining ring and air flow control orifice.
 - a. Membrane Diffuser: Incorporate an integral check valve into the membrane diffuser.
 - b. Design and test diffusers for a dynamic wet pressure (DWP) of 12 inches $\pm$ 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.
 - c. Visual Uniformity – Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.

- d. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.
- 7. Diffuser Holders and Retainer Rings:
 - a. Design holder with air flow control orifice. Holder to provide peripheral support for the diffuser.
 - b. Design retainer ring to seal the diffuser and O-ring in the holder to prevent air leakage around gasket.
 - c. Design retainer rings threads with minimum cross section of 1/8-inch and allow for one complete turn to engage threads.
- 8. Anchor Bolts: Provide a mechanical 304 SS expansion anchor bolts for embedment in 4000 psi concrete with a pullout safety factor of 4.
- F. Liquid Purge System: Provide a liquid purge system to drain the entire submerged aeration piping system for each aeration grid including airlift purge eductor line and control valve. The purge system shall use a solenoid valve for automatic operation coordinated with the SBR operation.
- G. Package spare parts in a separate container clearly marked as “Spare Parts” and provide inventory list on exterior of the container.
- H. Installation Procedures: Follow equipment manufacturer's recommendations and O&M manual for of equipment installation.
- I. Acceptable Manufacturers: Xylem Inc. Sanitaire Products

2.5 DECANT MECHANISM

- A. The SBR supplier to furnish decanter assemblies with drive actuator for each SBR basin. The decanters shall be designed to remove clarified effluent.

Decanter Quantity	2
Decanters per Basin	1
Decanter Weir Length	7.5 ft
Decanter Material of Construction	304L SS
Actuator Quantity	2
Actuators per Basin	1

Actuator Power Supply	460 V / 3 ph / 60Hz
Actuator Power	1/4 Hp

B. Design Parameters

1. Decanter design must allow for variable speed operation and fail-safe park position above TWL.
2. The maximum decanter loading at Normal Flow Mode condition shall not exceed 20 ft³/ft/min (1.8 m³/m/min). The maximum decanter loading at High Flow Mode condition shall not exceed 30 ft³/ft/min (2.8 m³/m/min).
3. The decanter weir and trough shall always be visible from the basin side wall thereby providing the operator with a visual check of the effluent quality during the decant phase of the cycle.
4. The decanter shall be parked above the design top water level during aeration and settling phases, thereby eliminating any possibility of solids carryover during these phases. Decanters floating on the liquid surface during aeration and settling, with the weir of entry ports submerged below the surface shall not be allowed.
5. At top park position, the decanter shall provide 'fail safe' overflow protection in the event of a power failure. Settled supernatant will flow via gravity, under the scum guard, over the weir, and into the decanters. In overflow event, this will allow for the entire depth of the basin (up to TWL) to be used for settling while overflowing the weir.
6. The decanter shall be designed with a scum guard mechanism to prevent the discharge of scum and floatables during decanter or overflow operation.
7. All in-basin seals and bearings shall be maintenance free.
8. Decanter assembly components requiring routine maintenance shall be accessible from the walkway and shall not require confined space entry into the basin.
9. The drive mechanism or actuator shall be designed for a continuous duty, variable speed mode of operation thereby producing a uniform effluent flow rate throughout the decant phase.
10. Actuator limit switches and motor shall be integrated with process control system to prevent blower operation during the decant phase of the cycle.
11. The decanter assembly shall not require effluent valves, valve vaults, flex joints, throttling capabilities, or dewatering supports.

C. Equipment

1. The decanters shall be supplied with the following components:
 - a. Upper collection trough with integral, overflow weir
 - b. Scum guard mechanism
 - c. Downcomer pipes
 - d. Collector pipe (for decanters >6ft)
 - e. Swivel Joint or Seals & bearings, as required
 - f. Electro-mechanical actuator
2. The drive mechanism or actuator shall consist of an electro-mechanical screw jack with protective boot and end position limit switches. The actuator shall be equipped with a VFD rated motor suitable for continuous duty in an outdoor, moist environment. The motor shall be driven by a variable frequency drive allowing the controls to vertically lower the decanter at a continuous and uniform rate.
3. The decanter shall not require spring loaded valves, flexible joints, and/or throttling effluent valves to control discharge rate.
4. The decanter must be self-supporting when the basin is drained.

D. Materials

1. All in-basin welded decanter components, except seals and bearings, shall be constructed of corrosion and ultra-violet resistant stainless steel. All fasteners shall be constructed of stainless steel.
2. The decanter seals and bearings shall be constructed of maintenance free, synthetic materials for longest possible service life. All seals and bearings shall be shipped factory assembled, simplifying installation.

E. Fabrication and Finishing

1. All decanter welding must be conducted by welders certified under ASME Code 9.
2. All joints to be finish tested for integrity by either air pressure (3.0 psi) or dye penetrate methods.
3. All finished decanter units to be free of abrasions, damage, flaws, carbon contamination and discoloration. All weld burn and discoloration shall be removed with pickle paste. All stainless-steel surfaces shall be passivated and shall have a pleasing and uniform passivated appearance. Decanters shall be power washed for final cleaning prior to shipment.

F. Acceptable Manufacturers:

1. Xylem Inc. Sanitaire Products

2.6 WASTE SLUDGE PUMPS

- A. The SBR supplier to furnish submersible non-clog wastewater pump(s), in each SBR basin. Leak detectors shall be used to sense water presence in the oil and stator housings.

Pump Quantity	2
Pumps per Basin	1
Pump Model	Flygt DP-3069/473
Design Flow Rate	110 gpm
Design TDH	40 ft
Design Shut Off Head	50 ft
Submersible Cable Length	30 ft
Lifting Chain Length	25 ft
Motor Power Supply	460 V / 3 ph / 60 Hz
Drive	2.4 Hp

B. Equipment

1. Each pump shall be equipped with a submersible electric motor with submersible cable (SUBCAB) suitable for submersible pump application.
2. The power cable shall be sized according to NEC and ICEA standards.
3. The pump shall be supplied with a mating cast iron 3-inch discharge connection.
4. Each pump shall be fitted with lifting chain or stainless steel cable.
5. The working load of the lifting system shall be 50% greater than the pump unit weight.

- C. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connection, guide by no less than two guide bars extending from the top of the station to discharge connection.

D. Pump Construction

1. Major pump components shall be of grey cast iron, ASTM A-48, Class 30B, with smooth surfaces devoid of blow holes or other irregularities.
2. All O-rings shall be of Nitrile Rubber. The lifting handle shall be stainless steel. Cast iron impellers shall be sprayed with primer.

E. Bearings: The upper bearing shall be a single row ball bearing. The lower bearing shall be a two row angular contact ball bearing. Motor bearings shall be permanently grease lubricated.

F. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies.

G. Cable Entry Seal

1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal.
2. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable.

H. Impeller: Impellers available for this pump model shall be either single-vaned, totally enclosed or multi-vaned, vortex type.

I. Wearing Rings: A wear ring system shall be used to provide efficient sealing between the volute and suction inlet for totally enclosed impellers. Each pump shall be furnished with a leaded red brass ring insert that is drive fitted to the volute inlet.

J. Volute: Pump volute(s) shall be single-piece grey cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

K. Acceptable Manufacturers:

1. Xylem Inc. Flygt Products

2.7 PROCESS CONTROL SYSTEM

A. General

1. The SBR supplier to furnish a complete SBR control system. This shall include a master control panel with a Graphic Operator Interface, Programmable Logic

Controller, Motor Starters, Variable Frequency Drives, Control Switches, and Pilot lights.

2. Local control stations shall be included for the Decaners
3. Motor Starters and Variable Frequency Drives shall be included in a separate Motor Control Center.

B. Control Panel

1. The control panel enclosure shall be a heavy duty, NEMA 12, enclosure with a flange mounted disconnect if three-phase power is required. The panel shall be made of 10-gauge steel and fully braced. The doors shall be heavy duty 3-point latching doors with a padlocking handle. The master circuit breaker disconnect shall be on the far right, and be interlocked with the doors.
2. Control power shall be provided by a transformer if three-phase power is required. In addition, a voltage filter and surge protective device shall be used for PLC and HMI power supply. The voltage filter will combine active tracking technology with UL listed surge protection against the full spectrum of voltage transients and surges. It must continuously track the input AC line power and respond instantly upon detecting extraneous high frequency noise and high voltage transients. The device must be UL1449 and UL1283 listed.
3. All control voltage branch feeders shall be protected by circuit breakers or fuses.
4. Control relays shall be electromechanical with touch safe screw terminals
5. Motor starters shall be UL Listed as a self-protected control device type of combination starter [rated at 42,000 AIC].
6. Terminal blocks shall be high-density type, rated for 600 VAC, 30 amp minimum. Ten percent spare terminals shall be provided. All devices shall be clearly marked and identified on the inside of the panel. All terminals and wires shall be clearly tagged in accordance with the schematic and wiring diagrams.

C. Programmable Logic Controller (PLC)

1. The Programmable Logic Controller (PLC) shall have a built in Ethernet port for network communications.
2. Acceptable Manufacturers: Rockwell Automation / Siemens.
3. Human Machine Interface (HMI)
4. A Graphic Operator Interface Terminal (HMI) shall be mounted on the front of the panel for control of the SBR as a means of controlling the system and shall provide

graphic display of the process parameters and equipment status on a color display. The HMI shall also allow for entry of setpoint changes for system control. The display shall be 15.5” widescreen touchscreen, aspect ratio 16:9. The display shall be connected to a DIN rail mounted industrial computer.

D. Human Machine Interface (HMI)

1. Graphical display of all status information available for each device in the biological treatment system in the form of a pop-up window for quick and easy access.
2. Display all smart sensor status information available from the sensors.
3. Electronic O&M Manuals for all hardware provided by the SBR manufacturer shall reside on the HMI and be quickly obtained by pushing a button.
4. Alarm screen that allows the operator to select an alarm and push a button to display troubleshooting tips for that alarm.
5. Easy navigation set up with control mode select buttons for each basin along the left and HMI screen navigation buttons along the top.
6. Maintenance dashboard screen with quick read gauges of maintenance life span for all biological treatment devices requiring maintenance.
7. Historical trend screen displays 10 days of key process variables, logged once per minute, including, where applicable, each basin’s DO, Temp, DO Setpoint, Level, Clock, Waste pump running and air valve opened signals.
8. HMI software shall provide a minimum of one (1) secure client, one (1) web client and one (1) SMA client license for operation staff use.

E. Remote connection:

1. A webport with a built in four-port Ethernet switch shall be provided to allow direct access for online technical support via a standard internet connection.
2. A customer account shall be set up by the supplier to allow operations staff access to view the plant HMI via the client licenses using a computer or other portable electronic device for the duration of the supplier’s warranty period. Starting at the expiration of the warranty period an annual fee shall be assessed by the biological treatment supplier to maintain the customer account/access

F. SBR Control Logic

1. The SBR controls shall operate on a time cycle basis. The process elapsed time will be displayed on the display terminal. Each pair of SBR tanks will operate on a

complimentary basis, so that while one tank is in aeration the other tank is in settling or decant phase. The cycle will automatically adjust for high flow conditions to increase the throughput capacity in high flow conditions. In automatic operation, the processor shall at all times maintain the proper sequence of operation even in the event of power failure. All phases of the process and equipment shall be interlocked so that the process cannot be upset. If an equipment failure takes place an alarm will be displayed on the operator terminal until cleared. The display will indicate the time of the alarm and status.

2. Time critical sequences and other process variables can be adjusted via the operator interface terminal as follows:
 - a. SBR Sequences shall consist of [1] Aeration blower run time, [2] The waste sludge pump start time and running time, [3] The decanter lowering rate, and [4] Special process variables such as DO or SIMS control setpoints if required
3. UV Interface: Each decanter shall have a non-mercury float switch mounted from the end of the weir. The float switch will trip when the decanter weir comes in contact with the water. Through the SBR control system a PLC digital output contact will close signaling the UV system that effluent flow is occurring. When the decanter weir is removed from the water and the float is no longer tripped the PLC output contact will open. The SBR operator interface shall have a selection on the set point screen which shall enable/disable the PLC output.
4. Chemical Feed: The SBR control system shall provide a PLC output contact that shall be used to turn on a chemical feed system. From the SBR operator interface there shall be the following set point selections.

Chemical Feed: Enable/Disable

Chemical Feed Start Time: Minute (determined by basin clock)

Chemical Feed Run Time: Minute, Seconds

A PLC digital output contact that shall close when the chemical feed is enabled and the start time set point equals the basin clock. The PLC output contact will remain closed until the run time is elapsed. This process will repeat itself every basin cycle.

5. The control system will include the following controllers, as well as instruments for monitoring process parameters, as detailed subsequently in this specification:
 - a. Hydraulic Controller
 - b. Decanter Controller
 - c. Aeration Controller

G. Acceptable Manufacturers:

1. Xylem Inc. Sanitaire Products.

2.8 MOTOR CONTROL CENTER

A. The SBR supplier to furnish a Motor Control Center shall be provided for all motors associated with the SBR equipment.

B. Equipment

1. The motor control center shall be Rockwell Automation / Siemens, or equal. The unit shall have main lugs and bus system, which shall be tin plated copper and shall be fully braced for 42,000A RMS AIC with continuous horizontal and vertical bus bracing. The bus shall be rated for a minimum of 600 amps. Molded polycarbonate isolating material will separate the main bus from the unit starters and wire way. The enclosure will have a NEMA 1 rating.
2. Motor starter disconnecting devices shall be magnetic type circuit protectors (HMCP) and rated for 100,000A RMS. Motor starters shall be NEMA rated, shall incorporate overload protection, surge suppressers, and disconnecting terminal blocks. Starters for motors 50 hp and above shall be solid state reduced voltage type. Control wiring shall be 16AWG, MTW copper and color coded by voltage. The MCC shall have a 4.3" vertical wire way separated from unit starters. The MCC shall have a full length copper ground bus. The motor control center shall be wired to NEMA Class 1, Type B standard.

C. Acceptable Manufacturers:

1. Rockwell Automation.

2.9 INSTRUMENTATION AND PROCESS CONTROL

A. The SBR supplier to furnish, configure and commission the instrumentation for the SBR system. In addition, the SBR supplier shall furnish the control algorithms detailed below to control the process with the supplied instrumentation.

	Location	No. per Zone	Total Count
Terminal/Controller	Transferable	-	1

DO	Aerated Zones	1	2

B. Terminal/Controller:

1. The analyzer shall be a digital multi-channel, multi-parameter system capable of controlling up to 20 sensors, in any combination, for the determination of water and wastewater parameters.
 - a. The controller must be configurable to include the following measurements: COD, TOC, DOC, SAC, BOD, pH, ORP, NH₄, NO₃, Conductivity, DO, Turbidity, TSS, Temperature and Sludge Level Monitor.
 - b. Communication between controller and sensor shall be digital, allowing cable runs up to 3,000 feet without further amplification.
 - c. The system will provide up to 20 programmable analog outputs (max. load 500 ohms) and 20 programmable alarm relays (rated to 5A at 250VAC). System shall also be capable of Ethernet/IP and Profibus IP communication.
 - d. 90VAC-264VAC power required.
 - e. Enclosure is NEMA-4X rated.
 - f. Entire system including the sensors shall have built in lightning and surge protection.
 - g. Ambient operating temperature –20°C to +55°C.
 - h. System diagnostics shall be standard.
 - i. System shall also have a USB interface port, data storage capability, and 3 levels of security.
 - j. System must have integrated lightning and overvoltage protection.
 - k. Backup controller function to increase reliability.
2. The terminal controller shall be YSI/WTW model 2020 IQ Sensor Net.
3. All instruments associated with the SBR system must be connected to the terminal/controller communication network back to the main SBR control panel.
4. Universal Mounting Kits with all necessary hardware shall be provided for each sensor.
5. A sunshield and mounting bracket shall be provided for the system display/controller and each local component to be mounted outside.

C. Hydraulic Controller

1. Description of controller

- a. The hydraulic controller is used to adjust the cycle time to accommodate increased flow events while maintaining treatment objectives.
- b. The hydraulic controller shall automatically switch back into a normal mode of operation once the hydraulic threshold has been maintained and an additional cycle has been completed.
- c. The hydraulic controller shall interface with the aeration controller to increase the settling time to minimum of 30 minutes during the high flow conditions.
- d. Include an integral safety feature interlocking the aeration and mixer controllers to prevent solids carryover in the decanter.
- e. Reduce energy and optimize process stability by maintaining the desired dissolved oxygen setpoint during aerobic phases of the react phase.
- f. The intent of the multiple modes of operation is to protect the process operation when instrumentation has faulted or is in need of maintenance.

2. Performance metrics

- a. Submit test data from a minimum of six (6) full-scale plants that demonstrates that the proposed hydraulic controller properly transitions to a high-flow cycle when operated continuously at the design peak flow rate, while meeting peak instantaneous NPDES permit levels for grab and composite samples, without water overflowing the basin walls.
- b. For each set of test data submitted, the test shall start at minute 0 of the cycle in the normal cycle, at which time the influent flow rate shall be increased to the peak design flow rate and maintained at that level until the end of the cycle.
- c. For each set of test data submitted, the control system must properly transition to the high-flow cycle, which shall be 75% of the normal cycle periods or less, without water overflowing into the decanter before the start of the decant cycle and without the decanter being submerged at any time.
- d. For each set of test data submitted, measurements of the basin water level during the test, as well as calculations of the hydraulic retention time (HRT) and weir loading rate (CFM/ft) shall be provided.

3. Instrument specification

- a. Each basin shall be equipped with a level transducer. The level transducer shall have a stainless steel body with a head-pressure-sensing bottom Teflon faced diaphragm and an internal precision, gage pressure transducer assembly. The transducer shall be cable mounted and factory calibrated for the basin depth. The transducer shall be a 2-wire type and produce a 4-20ma signal in direct proportion to the measured level.
- b. The level transducer shall be a Xylem Inc, Flygt Products LTU-40.
- c. Each basin shall be equipped with a high level non-mercury float switch.
- d. The float shall be a Xylem Inc, Flygt Products Model ENM-10.
- e. Level signals and level indication shall be used to control the high flow cycle time and to reduce the aeration time in case of extreme high flows.

D. Decanter Controller

1. Controller description

- a. Decanters shall be used to remove effluent from the SBR basins during the decant phase of the system cycle.
- b. The decanter controller uses an algorithm to descend the decanter weir throughout the cycle at a constant vertical rate ensuring a constant discharge flow rate.
- c. The decanter controller ensures proper synchronization between process decant time and weir position prior to the next phase starting to prevent solids contamination in the decanter effluent.
- d. When not at design flow the decanter idle time is at the beginning of the decant cycle to maximize settling time.
- e. Decanter speed will be controlled by a Variable Frequency Drive (VFD) which controls the speed of the decanter actuator motor.

2. Performance Metrics

- a. Shall ensure the decanter is above the water level prior to aeration of the tank such that solids cannot carryover the decanter 100% of the time during the transition from decant to aeration phase of the cycle.

3. System Components

- a. Decanter mechanism – as described in mechanical section of this specification
- b. Linear actuator – as described in mechanical section of this specification

c. Variable Frequency Drive (VFD):

- 1) The VFD shall be microprocessor based, all-digital, compact style, low-noise PWM type. It shall allow programming of the torque curve, speed and voltage, over current and overload protection. It shall have protective warning and diagnosis functions. The unit shall have programmed automatic fault restarts and low power ride through. The control unit display shall be mounted in an easily accessible location. The unit shall have a NEMA 1 rating suitable for mounting in a panel, on a wall, or in an MCC. The VFD will be setup, programmed, and post commissioned supported by Sanitaire personnel. The speed is determined by the PLC in order to maintain a uniform vertical lowering of the decanter weir. The maximum decanter travel is controlled by magnetic limit switches mounted on the decanter actuator. In addition, there shall be a decanter local control station for each basin consisting of a 4-position switch enclosed in a NEMA 4X enclosure. The local station allows manual raise and lower control as well as off and automatic control. The VFD must be properly wired and programmed so that manual raise and lower control does not require any input from the PLC.

E. Aeration Controller

1. Each basin shall be equipped with a dissolved oxygen probe.
 - a. Communication to controller shall be digital.
 - b. Connection to IQ Sensor Net shall be through two wire shielded cable.
 - c. The sensor shall be calibration free using intelligent membrane technology.
 - d. Membranes shall last up to two years with replacement membranes containing calibration data chip.
 - e. Sensor shall use soft green fluorescent light with calibrated optics and equal path reference system.
 - f. Sensor shall have a measuring range of 0-20.00 mg/l.
 - g. Sensor shall integrate temperature measurement and compensation.
 - h. Temperature operating range of -5° C to + 50° C and measuring range of -5° C to + 50° C.
 - i. System accuracy shall be $\pm 0.05 \text{ mg/l} < 1.00 \text{ mg/l}$, $\pm 0.1 \text{ mg/l} > 1.00 \text{ mg/l}$.
 - j. Sensor shall include self-diagnostics.

2. The DO sensor shall be YSI/WTW model FDO 700 IQ.
3. The dissolved oxygen signal shall be displayed at the main control panel display unit and be an input to the PLC. The PLC, using a control algorithm will output a 4-20mA signal to control the air flow out of the blower. The control system will control the airflow to provide only the amount of air required to maintain the dissolved oxygen set point.

F. Portable Suspended Solids System

1. The SBR supplier to furnish one (1) portable suspended solids system which shall consist of a minimum two major components, the analyzer and the sensor.
2. The analyzer shall be housed in a glass-filled nylon enclosure with a Velcro hand strap, which can also be converted to a belt mounting strap. Calibration shall not require an immediate known value and it shall not require a saved or retained sample.
3. The sensor shall be a single gap, optical sensor with twenty-five feet of Kevlar internally reinforced cable. The cable shall be marked in one-foot increments and be constructed of polyurethane and optical grade ground glass lenses.
4. The portable suspended solids system shall be Xylem Inc. Royce Technologies model 711, with a Model 71 sensor.
5. The portable unit shall be used for analyzing suspended solids and blanket interfaces in the reactor.

PART 3 - INSTALLATION AND PERFORMANCE

3.1 TESTING

- A. After completion of the installation, the equipment shall be tested by the Contractor in the presence of the Engineer under actual operating conditions. The test shall be conducted under the supervision of the manufacturer's technical representative.

3.2 BIOLOGICAL PROCESS PERFORMANCE GUARANTEE

- A. Supplier shall provide a Process Performance Guarantee to the Owner, guaranteeing the SBR process shall meet effluent wastewater quality, as determined during the Performance Test.

- B. The full Process Performance Guarantee language and details of the Performance Test; defining conditions of guarantee, responsibilities, testing protocol, sampling, and analysis shall be provided with the Equipment Submittal.
- C. The supplier shall guarantee that the SBR process shall meet effluent wastewater quality, as determined during the Performance Test equal to or less than the effluent quality as defined in paragraph 2.03 Effluent Quality Requirements.
- D. The influent wastewater to the SBR process shall be defined by paragraph 2.02 Influent Wastewater Characteristics. The influent BOD₅, TSS, TKN, and TP loadings are defined by the Maximum Month Flow and the respective concentrations as outlined in paragraph 2.02.
- E. The supplier shall provide a Process Performance Guarantee for the SBR system defined by paragraph 2.04 Process Design.

3.3 OXYGEN TRANSFER TEST

- A. Conduct a performance test to demonstrate capability of the aeration equipment to meet the specified oxygen transfer requirements.
- B. Base all tests on the following criteria:
 - 1. A minimum of 3 tests for each specified condition in complete accordance with ASCE Clean Water Test Procedure (1992 or latest edition)
 - 2. Conduct tests by an independent aeration testing firm in a full scale aeration test tank (minimum of 300 sq. ft.) at the specified submergence and water depth with a diffuser density equivalent to the specified tank configuration. Diffuser density is defined as the ratio of the total tank surface area to the total active diffuser surface area.
 - 3. Conduct shop test with air rate and mass rate of oxygen transfer directly proportional to the ratio of the shop test tank volume and the design tank volume.
 - 4. Plot of pounds of oxygen per day per 1000 cubic feet of tank volume versus air per 1000 cubic feet of tank volume in tap water at 14.7 Asia, 20°C and zero dissolved oxygen at the specified submergence.
- C. Certify and stamp all tests by a registered Professional Engineer.
- D. Include all costs for testing (exclusive of witnesses' expenses) in the equipment price. All tests may be witnessed at Owner/Engineer option. Cost of travel and living expenses for Owner/Engineer to be paid by the Owner.

- E. Submit all test data from oxygen transfer tests for approval by the Engineer prior to manufacturing equipment.

3.4 OPERATION AND MAINTENANCE MANUAL

- A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements.

3.5 FIELD SERVICES START-UP AND TRAINING

- A. The services of the field representative shall include minimum ten (10) days, exclusive of travel time, and two (2) travel trips. The Owner shall notify the manufacturer a minimum of ten working days prior to the time that the field services are desired.
- B. The Owner shall notify Sanitaire when the installation of the SBR equipment has been completed. A representative of the supplier shall inspect the installation. The Owner shall be advised in writing of any corrections or adjustments that are required for the SBR equipment installation. After the SBR installation has been completed to the supplier's satisfaction, a letter of certification that all equipment is installed in accordance with its instructions and that the SBR equipment is ready for operation shall be furnished.
- C. The field person shall do a functional check of each item furnished and start-up of the process. During this time, the field representative will provide operation training, which shall include familiarization with the SBR process, its requirement and review of the Operation and Maintenance Manuals.

END OF SECTION 465353.01

SECTION 466600 - ULTRAVIOLET DISINFECTION 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 SUMMARY

- A. This section covers ultraviolet disinfection units for disinfection of effluent from sequencing batch reactors prior to discharge.

Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.

- B. The UV system is to be furnished hereunder and shall be a complete package, UV3000 PTP as manufactured by Trojan Technologies.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- B. Pre-qualification Requirements: Any alternate UV manufacturer that is not named or listed as approved equal must submit the following 15 days prior to bid to be considered for approval:
 - 1. To be considered, the manufacturer will be regularly engaged in the manufacture of UV systems with a proven track record of at least one thousand (1,000) municipal installations in North America.
 - 2. The manufacturer will provide documentation of previous experience with municipal UV disinfection systems in wastewater applications with electronic ballasts.
 - 3. Pre-qualification submittals from manufacturers will include a complete and detailed proposal of equipment offered, including the number of lamps proposed and a detailed description of any exceptions taken to the specification.
 - 4. To be considered, the manufacturer will submit a bioassay evaluation for the proposed reactor. This bioassay will have been validated by an independent third

party and have followed protocols described in the US EPA Design Manual – Municipal Wastewater Disinfection (EPA/625/1-86/021), without exception. The manufacturer's bioassay report must demonstrate that the proposed UV system design and number of lamps will deliver the specified dose.

5. Documentation of UV manufacturer's service capabilities including location and experience.
6. Sample disinfection performance guarantee including scope and duration of guarantee- minimum of 5 years required.
7. All UV manufacturers will be required to pre-qualify, unless the manufacturer is the base bid manufacturer.

C. Design Criteria

1. Provide equipment which will disinfect an effluent with the following characteristics:
 - a. Peak Flow: 1 MGD
 - b. Total Suspended Solids: 30 mg/L (30-day, grab sample)
 - c. Ultraviolet Transmittance @ 253.7 nm: 65% (minimum)
 - d. Annual Effluent Temperature Range: 33 to 85 °F or 0 to 29 °C
 - e. Effluent standard to be guaranteed: 200 Fecal Coliform, 30 Day Geometric Mean
2. The UV equipment will be installed in a stainless steel channel furnished as part of this system, and having dimensions as shown on the drawings.
3. The system supplied will be arranged in the following manner.
 - a. Number of Lamps in each UV Lamp Module: 4
 - b. Number of UV Lamp Modules: 8
 - c. Number of UV Banks: 1
4. The lamp array configuration will be evenly spaced in both horizontal and vertical rows with all lamps parallel to each other and to the effluent flow.

D. Performance Requirements:

1. The UV system will be designed to deliver a minimum UV dose of 30 mJ/cm², in effluent with a UV Transmission of 65% after reductions for quartz sleeve absorption, sleeve fouling, and lamp aging. The basis for evaluating the UV dose delivered by the UV system will be the manufacturer's bioassay as carried out by

an independent third party. Bioassay validation methodology to follow protocols described in US EPA Design Manual - Municipal Wastewater Disinfection (EPA/625/1-86/021), without exception.

2. The UV system will produce an effluent conforming to the following discharge permit: 200 Fecal Coliform, 30-Day Geometric Mean. Grab samples will be taken in accordance with the Microbiology Sampling Techniques found in Standard Methods for the Examination of Water and Wastewater, 19th Ed.

1.4 GENERAL EQUIPMENT STIPULATIONS

- A. All equipment shall be designed, fabricated and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts furnished at any time can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
- B. All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.
- C. Painted surfaces shall be protected against impact, abrasion, discoloration and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of the Engineer.
- D. Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the shop drawings. Complete packing lists and bills of material shall be included with each shipment.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.
 1. Complete description in sufficient detail to permit an item comparison with the specification.
 2. Dimensions and installation requirements.
 3. Descriptive information including catalog cuts and manufacturers specifications for components.
 4. Electrical schematics and layouts.

5. Independent bioassay report demonstrating dose delivered under design conditions.
6. Experience documentation.

1.6 WARRANTY

A. Equipment:

1. The equipment furnished under this section will be free of defects in material and workmanship, including damages that may be incurred during shipping for a period of 12 months from date of substantial completion or 18 months after shipment, whichever comes first.

B. UV Lamps:

1. The UV lamps to be warranted for a minimum of 12,000 hours (non-prorated) or thirty-six (36) calendar months from shipment, whichever comes first. Pro-rated lamp warranties will not be accepted. On / off cycles are limited to an average of four (4) per day without exception.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT DESCRIPTION

- A. Provide a UV disinfection system complete with UV lamp modules, effluent channel, level control, and UV monitoring system as shown on the Contract Drawings and as herein specified.
- B. UV system will be designed for complete outdoor installation, without shelter or supplemental cooling or heating required.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. Service Conditions:

1. The UV disinfection units will be used to disinfect wastewater which has undergone treatment through a sequencing batch reactor.

B. General:

1. All material in contact with effluent will be stainless steel or quartz.
2. All material exposed to UV light will be stainless steel, anodized aluminum, quartz 214, or Teflon™.

2.3 ULTRAVIOLET DISINFECTION SYSTEM

A. UV Module (UVM):

1. Each UV lamp module will consist of 4 lamps and their corresponding electronic ballast. Each lamp will be enclosed in its individual quartz sleeve, one end of which will be closed and the other end sealed by a lamp end seal and holder.
2. The electrical wires connecting the lamps to the electronic ballasts will be enclosed in the stainless steel frame. Systems where lamp wiring is submerged in the effluent and exposed to UV light will not be allowed.
3. Each UV module will be provided with a standard 120 Volt plug and weatherproof cable for connection to a receptacle. The cable will be 10 ft (3.0 m). A total of 8 UV modules will be supplied. Lamp status will be displayed on top of each UV module using watertight LED indicator lights.
4. Modules will be approximately 68.20 in long, 20.10 in high and 2.8 inches (7.1 cm) wide, weighing approximately 38 lbs. Materials of construction will be stainless steel type 316, anodized aluminum, quartz 214, and Teflon™, with UL rating of Type 6P

B. UV Lamps:

1. UV system will use low pressure mercury slimline lamps of the hot cathode, instant start design.
2. 90% of UV output will be within the wavelengths of 233.7 to 273.7 nm.
3. The operating life of the lamp will be guaranteed for 12,000 hours, non pro-rated.
4. Independent validation of lamps aging factor is required.

C. Lamp End Seal and Lamp Holder:

1. The open end of the lamp sleeve will be sealed by means of a sleeve nut which threads onto a sleeve cup and compresses the sleeve 'O' ring.
2. The sleeve nut will have a knurled surface to allow a positive handgrip for tightening. The sleeve nut will not require any tools for removal.

D. UV Lamp Sleeves:

1. Quartz sleeves to be Type 214 clear fused quartz circular tubing as manufactured by General Electric or equal.
2. Quartz to be rated for UV transmission of 89% and not subject to solarization.
3. The nominal wall thickness will be 1.0 to 2.0 mm to maximize UV transmission.

E. Effluent Channel:

1. Each UV unit will be provided with one (1) effluent channel complete with drain (if concrete provided by other if stainless steel by UV manufacturer), UV module support rack and downstream level control weir.
2. The effluent channel will have the following dimensions: Length 9 ft 7 in, width 2 ft, and height 1 ft 11 in.

F. Level Control Weir:

1. Weir will be located downstream of the UV modules to maintain an average water depth of 11 inches/cm and ensure lamp submergence at all times.
2. Maximum effluent level variance from zero to peak flow will not exceed 1.5 inches (3.8 cm).
3. Weir will be welded water tight and include a drain.

G. Electrical:

1. The UV disinfection system will be divided into 8 UV modules.
2. Interconnecting Cables to be standard 120 Volt, weatherproof, 10 feet (3.0 m) long and will be suitable for outdoor installation.
3. Power Distribution Receptacles:
 - a. 120 Volt receptacles rated for continuous outdoor use will be provided. Receptacles will be of the duplex type complete with ground fault interrupter circuitry.
 - b. Receptacles to be provided by the UV Manufacturer.
4. Power Consumption:
 - a. Maximum power draw to UV System will be 2.80 kilowatts.
 - b. All electrical supplies will be 120 Volt, 60 Hz.
 - c. A separate 120 volt, 5 amp supply to be provided for the Monitoring System.

H. Cleaning Procedure:

1. The UV lamp modules will be cleaned by removing from the effluent channel and hand wiping the sleeves with an acid solution, using a non-abrasive cloth.

I. Monitoring System:

1. 1 submersible UV sensor(s) per bank will continuously monitor the UV intensity produced in the bank of UV lamp modules. The sensor will measure the germicidal portion of the light emitted by the UV lamps.
2. UV intensity will be indicated on a 3 character display in mW/cm².
3. Elapsed time in hours (lamp age) will be indicated on a 5 character display.
4. Both displays will utilize LEDs and will be visible through the panel door.
5. A dry contact will be provided for remote indication of Low UV intensity alarm.
6. Monitoring System will be enclosed in a Fiberglass Type 4X wall mounted panel and is to be located less than twelve (12) feet (3.66 m) from the LED end of the UV Module.

J. Power Distribution Receptacle (PDR):

1. Duplex ground fault interrupter receptacle(s) will be provided by the UV Manufacturer.
2. Receptacles will be mounted in an individual, impact resistant thermoplastic junction box complete with a Type 3R rain shield for outdoor installation.
3. Contractor to supply appropriate 120 Volt, single phase, 60 Hz circuit to power the PDRs which have a total current draw of approximately 25.40 amps. Contractor to be responsible for distributing the power from the main 120 Volt feed to the individual PDRs. Responsibility to be all encompassing and in accordance with the local electrical codes.

K. Transition Connections

1. 1 inlet and 1 outlet transition box(es) will be supplied per channel.
2. The material of construction for the transition boxes will be stainless steel type 304, 14 gauge.
3. Openings on the transition boxes (for flange connections) conform to ANSI standards and have dimensions as shown on the Contract Drawings.

L. Maintenance Rack:

1. Type 304 stainless steel maintenance rack(s) will be supplied. The rack is designed to hold UV modules during service or maintenance.

M. Spare Parts:

1. The following additional parts will be furnished:
 - a. 4 UV Lamps

- b. 4 Lamp Sleeves
- c. 4 Lamp Holders
- d. 1 Operators Kit (including 1 face shield, gloves)

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTALLATION AND START UP SERVICES

A. Manufacturer's Field Representative:

1. The UV equipment manufacturer shall furnish a competent, qualified field representative to perform manufacturer's field services, including start up, adjustment and instruction of the Owner's personnel in operation and maintenance of all materials and equipment furnished. The UV equipment manufacturer shall furnish to the Owner, through the Engineer, a written report certifying that the equipment has been properly installed.

B. Installation:

1. Installation procedure shall be as recommended by the UV manufacturer.

C. Customer Training:

1. The UV equipment manufacturer shall provide a qualified representative at the job site to train the Owner's personnel in operating and maintaining the equipment. The training session shall include a technical explanation of the equipment and an actual hands-on demonstration. The training session shall consist of one full 8-hour working day and the schedule shall be arranged and coordinated with the Owner.

3.2 DRAWINGS AND SUBMITTALS

- #### A.
- Complete fabrication, assembly and installation drawings, schematics and wiring diagrams together with detailed specifications and data covering material forming a part of the equipment furnished shall be submitted in accordance with the submittals sections.

END OF SECTION 466600

SECTION 6
STANDARD SPECIFICATIONS

STANDARD SPECIFICATIONS

1. The "Construction and Material Specifications" of the State of Ohio Department of Transportation (ODOT), 2023 edition, current ODOT supplemental specifications, and current ODOT standard drawings shall govern work and materials which are not specified or modified herein or on the project Contract Drawings. All references to "the Department" shall be changed to "the Owner or his Representative." The project Contract Drawings and Specifications, in the event of a discrepancy, shall supersede the ODOT Specifications.

The absence of an "As Per Plan" designation on some item descriptions in the proposal for which there are clear and controlling plan notes, specifications, or other requirements does not relieve the Contractor of the responsibility to read, bid and construct those particular items in accordance with the governing plan notes, specifications, or other requirements and the Contractor shall have no basis of claim based upon an "order of precedence".

ODOT 104.02 D., 611.04, 611.12, and 611.13 shall not apply to this project.

SECTION 7
SPECIFIC PROJECT REQUIREMENTS

SPECIFIC PROJECT REQUIREMENTS

1 - CONTACT DURING BIDDING

- 1.1 All questions during bidding should be addressed to Nicole Diak, PE, Verdantas LLC, by email at V200619@verdantas.com.

2 - GEOTECHNICAL SUBSURFACE INVESTIGATION

- 2.1 A Geotechnical Subsurface Investigation dated June 11, 2026 by Verdantas LLC was relied upon by the Engineer in the preparation of drawings and specifications. Copies of the report are provided along with each bid set but are not considered to be part of the contract documents.

3 - REFERENCE DRAWINGS

- 3.1 Reference Drawings dated October 2, 2002 of the 2003 Sewage Improvements project were relied upon by the Engineer in the preparation of drawings and specifications. Copies of the drawings may be examined on the internet at <https://bids.verdantas.com> but are not considered to be part of the bid documents.

4 - INSURANCE

- 4.1 See the following Bid Set Sections for Insurance Requirements:
- A. Section 1, Instructions to Bidders, Part 10 Insurance
 - B. Section 3, General Conditions, Article 5 Bonds and Insurance (EJCDC) or Article 11 Insurance and Bonds (AIA), whichever is used in the Bid Set
 - C. Section 4, Supplemental Conditions

5 - WORKING HOURS

- 5.1 No work shall be performed between the hours of 7:30 p.m. and 7:30 a.m. nor on Saturday, Sunday, or legal Holidays, without written permission of the Owner.

6 - PROJECT COMPLETION

- 6.1 All work including restoration and clean-up shall be completed no later than the contract completion date. Failure to complete all work within the allotted time will result in assessment of liquidated damages. Upon completion of all work and written notification of same by the Contractor, the Engineer and Owner will compile a punch list. The punch list will be sent to the Contractor. All punch list work shall be completed to the satisfaction of the Engineer and the Owner within 14 days after receipt of the punch list. Failure to complete the punch list work within the allotted time will result in assessment of liquidated damages.

7 - SUBSTANCE USE PREVENTION AND RECOVERY (SUPR) PROGRAM

- 7.1 Formerly known as the Drug-Free Safety Program, is BWC's voluntary safety program developed to address workplace use and misuse of alcohol and other drugs. During the life of this project, the Contractor and all its Subcontractors that provide labor on the Project site must be enrolled in and remain in good standing in the Ohio Bureau of Worker's Compensation ("OBWC") Substance Use Prevention and Recovery (SUPR) or a comparable program approved by the OBWC.

8 - OHIO ETHICS LAW

- 8.1 Contractor agrees that it is currently in compliance and will continue to adhere to the requirements of Ohio Ethics law as provided by Section 102.03 and 102.04 of the Ohio Revised Code.

9 - PERIODIC PAYMENTS

- 9.1 This project is expected to be funded in whole or in part by the Ohio EPA **WPCLF** Program. The Contractor shall comply with all requirements of this program. The periodic payments to the Contractor may be made in whole or in part through the OWNER and/or OWDA. In paragraph 14.02 C.1. of the General Conditions, change "ten days" to "sixty days."
- 9.2 Ohio EPA must approve all change orders prior to a change order item being paid on a pay estimate.

10 - SIGNAGE

- 10.1 (If the recipient has decided to pick the physical sign option of the grant's Signage Term and Condition) The Contractor is required to place a physical sign displaying the EPA logo at the construction site for this project in an easily visible location that can be directly linked to the work taking place. The sign must be maintained in good condition throughout the construction period. In cases where the construction site covers a large area (e.g., lead service line replacement or septic tank repair/replacement projects), a sign should be placed in an easily visible location near where the work is being performed (e.g., entrance to the neighborhood, along a main road through town, etc.). Signage costs are considered an allowable grant expense, provided the costs associated with the signage are reasonable. Additionally, to increase public awareness of projects serving communities where English is not the predominant language, assistance contractors are encouraged to translate the language on signs (excluding the EPA logo or seal) into the appropriate non-English language(s). The costs of such translation are allowable grant expenses, provided the costs are reasonable.
- 10.2 Procuring Signs: Consistent with Section 6002 of RCRA, 42 U.S.C. 6962, and 2 C.F.R. 200.323, contractors are encouraged to use recycled or recovered materials when procuring signs.

- 10.3 EPA Logo: The contractor will ensure that signage displays the EPA logo. The EPA logo must not be displayed in a manner that implies that EPA itself is conducting the project. Instead, the EPA logo must be accompanied with a statement indicating that the contractor received financial assistance from EPA for the project.
- 10.4 The contractor will ensure compliance with the sign specifications provided by the EPA Office of Public Affairs (OPA) available at: <https://www.epa.gov/grants/epa-logo-seal-specifications-signage-produced-epa-assistance-agreement-recipients>. As provided in the sign specifications from OPA, the EPA logo is the preferred identifier for assistance agreement projects and use of the EPA seal requires prior approval from the EPA. To obtain the appropriate EPA logo or seal graphic file, the contractor should send a request directly to Londa Scott-Forte (scott-forte.londa@epa.gov) (202-564-1504) and Jini Ryan (ryan.jini@epa.gov) (202-564-1075). Please explain in the message that the EPA logo is to be used on signage at a construction site funded with EPA assistance and copy the EPA Project Officer on the message.

END OF SECTION

SECTION 8
SPECIAL REQUIREMENTS – EPA

Contract Document Provisions

- The following contract requirements and forms are to be included in the construction contract documents. Completed copies of the forms are to be submitted to Ohio EPA within one week after bids are received, or sooner, dependent on your individual project schedule. Bid packages for WPCLF projects should be submitted to DEFA in the central office while bid packages for WSRLA projects should be submitted to the appropriate DDAGW district office.

Equal Employment Opportunity (EEO) Requirements

The Contractor's EEO Certification Form must be (1) included in the contract documents and (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

NOTE: If the loan applicant has its own EEO requirements, local procedures and forms may be substituted for the EPA form.

Debarment

The Certification Regarding Debarment, Suspension, and Other Responsibility Matters must be (1) included in the contract documents and (2) referenced in the Instructions to Bidders, informing bidders that the form must be completed and submitted with their bid.

Disadvantaged Business Enterprises (DBE) Utilization

The DBE Specification language and instructions to the bidders and Forms 6100-3, 6100-4 and 6100-2 must be (1) included in the contract documents and (2) referenced in the Instructions to Bidders, informing bidders that the forms must be completed and submitted with their bid.

NOTE: If the loan applicant has its own DBE requirements or if other funding programs with potentially competing DBE requirements are participating in the project funding, please contact Ohio EPA – DEFA for specific instructions regarding the DBE requirements.

Davis-Bacon wage rate requirements

The contract documents must include language that requires contractors and subcontractors to pay wages at rates not less than those prevailing on similar projects within the area as determined by the US Secretary of Labor. In addition, the loan recipient will be required to conduct wage interviews and monitor payroll for compliance.

American Iron and Steel

All treatment works projects funded by a WPCLF assistance agreement and all public water system projects funded by a WSRLA assistance agreement are required to comply with American Iron and Steel (AIS) requirements. The acknowledgement form must be included in the contract documents. The acknowledgement form should be signed by the contractor and submitted with the final bid package. It is recommended that the AIS guidance document and questions and answers document be included in the contract documents.

- The following contract requirements are to be included in the construction contract documents but are not required to be submitted to Ohio EPA for contract endorsement.

Violating Facilities Clause

Language prohibiting this use of equipment or services from anyone on the EPA List of Violating Facilities must be included in the contract documents.

Small Businesses in Rural Areas (SBRA)

Language encouraging the participation of small businesses in rural areas should be included in the contract documents.

Prohibition on Telecommunications and Video Surveillance

Restrictions to loan recipients and subrecipients on certain telecommunications and video surveillance services or equipment due to Public Law 115-232.

Insurance Provisions

Section 3.5 of the WPCLF/WSRLA Loan Agreement contains specific requirements regarding insurance for all contractors and all subcontractors for the life of the contract. These insurance requirements must be reflected in the contract documents. Adjust the language as needed to meet the specifics of the construction project while still meeting the provisions of the Loan Agreement.

Materials Testing

In addition to the details included with specific equipment testing in the specifications, there should be an overall statement regarding testing for the project. Adjust the language as needed to meet the specifics of the construction project.

Continuous Treatment Provisions

It is important that construction activities not result in any temporary violations of Drinking Water or NPDES permit requirements (for permitted facilities). Construction activities should interrupt wastewater service to the individual resident as little as possible. For drinking water projects, it is important that construction activities not result in any disruption of service. The example language is intended for construction work occurring at an existing drinking water plant or a WWTP and must be adjusted to meet the specifics of the construction project.

WPCLF/WSRLA Change Order Form

All change orders for the construction project must be executed on the WPCLF/WSRLA change order form. The form must be (1) included in the contract documents and (2) the instructions referenced in the Contract Documents.

- The following contract requirements are provided in Ohio Revised Code (ORC). Some loan applicants have local requirements that supersede ORC provisions for competitive bidding, and these local requirements can be applied instead of ORC, except for those requirements specified in the WPCLF/WSRLA loan agreements.

Bid Guarantee

The requirements for a bid guarantee (which can be a bond or a certified check, cashier's check, or letter of credit) are covered in ORC 153.54.

Payment and Performance Bonds

The requirements for a Payment and Performance Bond are covered in ORC 153.54 and Section 3.4 of the WPCLF/WSRLA Loan Agreements.

Payment Retention

The requirement for payment retainage is provided in ORC 153.12. Details on how the escrow account that holds the retainage are provided in ORC 153.13. Further details on how and when to pay for materials delivered and installed are provided in ORC 153.14.

Completion Time

The contract documents must state the length of the contract time per ORC 153.19. The dates for Initiation of Operation and Project Completion are specified in the WPCLF/WSRLA Loan Agreements and need to coincide with the specified contract time.

- The following are contract provisions to consider but are not required. The language provided for each are samples only and must be adjusted to reflect the specifics of the project and local needs.

Local Protest Procedure

Some statement as to when a valid protest must be filed, in what form it must be filed and who it must be filed with should be included. ORC 153.12 has some default procedures for handling disputes. If the owner wants more control than provided in ORC, a procedure needs to be spelled out in the Contract Documents.

[Basis and Method for Award](#)

The contract documents should include some language that clearly states what the Owner will consider when determining the successful bidder and to provide a clear basis for the Owner when they have a need to reject the low bidder and go with a different bidder.

[Payment Methods](#)

To minimize uncertainty and arguments that can slow down the progress of construction it is useful to provide language stating how and when the Contractor will get paid. In addition to ORC and other local requirements, the involvement of public funding Agencies such as the WPCLF, WSRLA, Ohio Public Works Commission and Community Development Block Grant impact the process and timing for payments.

Contract Documents Review (pre-advertising)

Whenever possible, all the provisions listed above must be included in the contract documents for the project prior to advertisement for bids. Ohio EPA's review for these contract provisions will occur as part of our normal detail plans and specifications review. The bidding documents are to be submitted to Ohio EPA for review regardless of whether a Permit to Install or a Plan Approval is required for the project.

After bidding has started:

In those cases when WPCLF or WSRLA funding is being requested after advertisement for bids has started, add all missing contract provisions, forms, and requirements via addendum.

After bids have been opened but before contracts have been signed:

If the bid advertisement period is over and bids have been opened, but the construction contract have not been signed yet, provide a draft contract change order which would be used to incorporate all missing contract provisions, forms, and requirements into the contract. This should be done in consultation with local legal counsel to address any potential bid protest concerns.

Construction contracts have already been signed:

If the construction contract has already been signed, a contract change order must be executed incorporating all missing contract provisions, forms, and requirements into the contract.

A [Contract Documents Review checklist](#) is provided here to help ensure that all requirements are included and to help expedite Ohio EPA's review of your documents.

Bid Package Submittals (post-advertising)

Certain documents must be submitted to Ohio EPA within one week after bids are received, or sooner dependent on your individual project schedule. Please [look here for a complete list](#) of the required submittals.

Disadvantaged Business Enterprises (DBE) Utilization

(Required Contract Provision)

USEPA has a program to encourage the participation of disadvantaged businesses in the construction activities funded by the Clean Water and Drinking Water SRF's. "DBE" is an all-inclusive term that includes Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Small Business Enterprises (SBE), Small Business in Rural Areas (SBRA), HUBZone Small Business, Labor Surplus Area Firms (LSAF), and other entities defined as socially and/or economically disadvantaged. While the WPCLF and WSRLA strongly encourage participation by all disadvantaged groups, specific participation goals are negotiated with USEPA only for Minority Business Enterprises and Women's Business Enterprises.

Goals

As a condition of receiving capitalization grants from U.S. EPA for the Water Pollution Control Loan Fund (WPCLF) and the Water Supply Revolving Loan Account (WSRLA), the Ohio EPA negotiates "fair share" Disadvantaged Business Enterprises (DBE) objectives with U.S. EPA. **The current negotiated goal for construction related activities is 5.4% (the total goal is based on 3.1% of MBEs and 2.3% of WBEs participation).** Recently, the USEPA issued a class exemption on some Disadvantaged Business Enterprise (DBE) requirements: <https://www.epa.gov/grants/rain-2025-g02>. While the exemption removes reporting and recordkeeping requirements it does not eliminate the good faith effort (GFE) requirement. As noted in this exemption, "Nothing in this class exception and waiver affects EPA's statutory obligations or agency and recipient obligations under [2 CFR Part 200](#), Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, including the considerations ("GFE") listed in [2 CFR 200.321](#) when procuring goods and services under the EPA award." Based on the language of the exemption, the current DBE goal for Ohio EPA State Revolving Funds (SRFs) are still in place and a GFE is mandatory for all loan recipients that do not meet the DBE goal.

DBE Certification

Under the DBE program, qualified DBE's are those that have been certified as an MBE or WBE. Certifications can be obtained from a federal agency such as the Small Business Administration or the Department of Transportation or by an approved State agency. The Unified Certification Program (UCP) administered by the Ohio Department of Transportation (ODOT) can provide the necessary DBE certifications. Information on the UCP can be found at www.ohioucp.org as well as the ODOT website <https://www.transportation.ohio.gov/programs/business-economic-opportunity/dbe>. The Department of Development operates the Encouraging Diversity Growth and Equity Program (EDGE), the other state approved DBE certification program. Information on EDGE can be found at <https://development.ohio.gov/business/minority-business/business-certifications/encouraging-diversity-growth-and-equity-program>.

On September 30, 2025, USDOT issued an interim final ruling in regard to the DBE program. Changes to the DBE guidelines have affected the ODOT certification program, but it does not affect the requirement for SRFs to meet the GFE for DBE participation.

All previously certified DBEs through the ODOT DBE program are no longer effective and all DBEs will need to resubmit for certification that follows the new guidelines. DAS EDGE is unaffected by this change and can be used as part of the SRF requirements towards meeting the DBE goals of 5.4% of each loan. Because the ODOT

program currently does not include any certified DBEs, Ohio EPA will accept any certified DBEs through non-SR.EPA.5

approved certification programs that follow the ODOT program 51% ownership requirement as part of a GFE to meet the DBE goals.

DBE Qualifications

To qualify for MBE certification, businesses must be 51 percent owned and controlled by a U.S. citizen and Ohio resident belonging to an African American, Native American, Hispanic, or Asian American ethnic group. In addition, the business must be in operation for at least one year prior to submitting an application. For DBE status, a business must be at least 51 percent owned by a socially and economically disadvantaged person who participates in the daily operations of the business. This person must be a woman or of African-American, Hispanic, Native American, Asian American ethnicity.

Program Requirements

To comply with DBE program requirements the WPCLF/WSRLA loan recipient must do the following:

1. Create and maintain a bidder's list (see description below)
2. Include contract conditions applicable to the DBE program in all procurement contracts entered into by the Borrower for all WPCLF and WSRLA projects. These conditions are listed below.
3. Follow, document, and maintain documentation of good faith efforts on the part of prime contractors to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project.
4. Review the Form 6100-3 and 6100-4 submittals provided by bidders on the project for completeness and obtain any additional information necessary to verify the certification status of all proposed subcontractors.
5. Obtain documentation of the good faith efforts of the prime contractor if the prime contractor does not meet the MBE or WBE goal.
6. Obtain a written confirmation from any prime contractor states that they will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual.
7. Submit the following to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined:
 - Form 6100-3 from each subcontractor
 - Form 6100-4 from each prime contractor
 - A copy of the Good Faith Efforts documentation from any prime contractors that will not meet the MBE and WBE goals,
 - If any of the prime contractors will not meet the MBE and WBE goals because they will not be entering into any agreements for goods or services with any company, firm, joint venture, or individual, a copy of the written confirmation from that prime contractor

NOTE: It is up to the WPCLF/WSRLA loan recipient whether or not to require completion and submission of Forms 6100-3 and 6100-4 from all bidders with the bid proposal or to accept completion and submission from the successful bidder(s) only at some time after bids are received. Regardless of whether the forms are completed and submitted with the bids or at some later time once the successful bidders are identified, completed forms are to be submitted to Ohio EPA with bid package.

To comply with DBE program requirements all prime contractors must do the following:

1. Follow, document, and maintain documentation of their good faith efforts.
2. Complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the bid proposal package to the loan recipient.
3. Have its Disadvantaged Business Enterprise subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form** and submit those as part of the bid proposal package to the loan recipient.
4. Provide **Form 6100-2 DBE Subcontractor Actual Participation Form** to all of its Disadvantaged Business Enterprise subcontractors for completion at the end of the work.

Bidders List

The Borrower must create, maintain, and use a bidders list for purposes of soliciting both MBE/WBEs and non-MBE/WBEs during procurement of construction, equipment, supplies, and services. This list shall include:

1. Entity's name with point of contact;
2. Entity's mailing address, telephone number, and e-mail address;
3. The procurement on which the entity bid or quoted, and when; and
4. Entity's status as an MBE/WBE or non-MBE/WBE.

Borrowers that receive less than \$250,000 or less in any one fiscal year can be exempt from maintaining a Bidders List.

The Bidders List shall be maintained until the project period has expired and the Borrower is no longer receiving EPA funding. The Bidders List must include all firms that bid on the prime contracts, or bid or gave a quote on subcontracts, including both MBE/WBEs and non-MBE/WBEs.

Required Contract Conditions

The DBE Specification language and instructions to the bidders and Forms 6100-2, 6100-3 and 6100-4 must be included in the contract documents and referenced in the Instructions to Bidders, informing bidders that the forms must be completed and submitted with their bid for all WPCLF and WSRLA projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the owner.
2. The prime contractor must notify the owner in writing prior to the termination of any Disadvantage Business Enterprise subcontractor for convenience by the prime contractor.
3. If a Disadvantage Business Enterprise contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six Good Faith Efforts (listed below) if soliciting a replacement contractor.
4. The prime contractor must employ the six Good Faith Efforts even if the prime contractor has achieved its fair share objectives.
5. An owner must ensure that each procurement contract it awards contains the following terms and conditions:

The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

Good Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts as listed below to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

DBE Forms

Form 6100-3 – Each prime contractor must have its DBE subcontractors complete **Form 6100-3 DBE Subcontractor Proposed Performance Form**. This form gives the DBE subcontractor the opportunity to report the scope and cost of the subcontract and it should be forwarded to the Prime Contractor along with the DBE's quote. Each subcontractor completes one Form 6100-3. The Borrower must submit all Form 6100-3 forms to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Form 6100-4 – Each prime contractor must complete and submit **Form 6100-4 DBE Subcontractor Utilization Summary** as part of the prime contractor's bid proposal package to the Borrower. This form summarizes the Prime Contractor's intended use of identified DBE(s) and the estimated dollar amount of each subcontract. Only one Form 6100-4 form is required from each Prime Contractor. The Borrower must submit this form to the Ohio EPA/DEFA as part of the bid package upon which the WPCLF/WSRLA loan amount is determined.

Violating Facilities Clause

Violating Facilities:

The Contractor agrees to comply with all applicable standards, orders or requirements under Section 306 of the Clean Air Act, 42 USC 1857 (h), Section 508 of the Clean Water Act, 33 USC 1368, Executive Order 11738, and EPA regulations, 40 CFR Part 32, which prohibits the use under non-exempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

Requirement For Utilization Of Small Businesses In Rural Areas (SBRA)

This procurement is subject to the EPA policy of encouraging the participation of small businesses in rural areas. It is EPA policy that recipients of EPA financial assistance awards utilize the services of small businesses in rural areas (SBRAs), to the maximum extent practicable. The objective is to assure that such small business entities are afforded the maximum practicable opportunity to participate as subcontractors, suppliers and otherwise in EPA-awarded financial assistance programs. This policy applies to all contracts and subcontracts for supplies, construction, and services under EPA grants or cooperative agreements. Small purchases are also subject to this policy.

This procurement is subject to the EPA policy of encouraging the participation of small business in rural areas (SBRAs).

Local Protest Procedure

Protests

A protest based upon an alleged violation of the procurement requirement may be filed against the OWNER's procurement action by a party with an adversely affected direct financial interest. The protest shall be filed with the Mayor. The OWNER shall determine the protest. The OWNER may request additional information or a hearing in order to resolve the protest.

A protest shall be filed as early as possible during the procurement process, but must be received by the OWNER no later than one week after the basis of the protest is known or should have been known, whichever is earlier. If the protest is mailed, the protester bears the risk of nondelivery within the required time period.

A protest must clearly present the procurement requirement being protested, the facts which support the protest, and any other information necessary to support the protest.

Continuous Treatment Provisions

It is important that construction activities not result in any temporary violations of NPDES permit requirements (for permitted facilities) and construction activities should interrupt wastewater service to the individual resident as little as possible. For drinking water projects, it is important that construction activities not result in any disruption of service. Any disruption of service must be immediately reported to the Ohio EPA, Drinking Water Section of the appropriate district office.

Continuous Treatment (wastewater projects)

Federal regulations prohibit by-passing of any sewage during construction operations. The Contractor will be responsible for providing any required temporary pumping facilities piping, etc., necessary to complete the project without any plant by-passing and continuous treatment must be provided at the same level during construction as existed prior to construction.

Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to the performance of the work required to complete their Contract.

Continuous Treatment (drinking water projects)

The Contractor will be responsible for obtaining approval from Ohio EPA for use of temporary pumping facilities, piping and other items in order to complete the project without any plant by-passing. Continuous treatment must be provided at the same level during construction as existed prior to construction.

Unless otherwise previously or subsequently specified, the Contractor shall procure and pay for all permits, licenses, and approvals necessary for the execution of his Contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to the performance of the work required to complete their Contract.

WPCLF/WSRLA Payments

This project is funded in whole or in part by funds from the Water Pollution Control Loan Fund (WPCLF) or the Water Supply Revolving Loan Account (WSRLA) as administered by the Ohio EPA-DEFA and the Ohio Water Development Authority (OWDA). The Contractor shall comply with all requirements of these programs. The Owner shall be responsible for the progress payments to the Contractor if the Owner becomes ineligible for further payments due to circumstances which are of no fault of the Contractor. The monthly payments to vendors may be made through the Owner, the OWDA, or both as deemed by the Owner.

The time frame for payment of pay estimates by the Owner and/or Special Funding Agency(s) may be up to 60 calendar days from date of receipt of pay estimate from Engineer to Owner. Ohio EPA/DEFA must approve all change orders before the change order may be submitted for payment on a pay estimate.

State of Ohio
WATER POLLUTION CONTROL LOAN FUND (WPCLF) /
WATER SUPPLY REVOLVING LOAN ACCOUNT (WSRLA)

CONTRACT CHANGE ORDER

RECIPIENT _____ CHANGE ORDER NBR _____
LOAN NUMBER _____ CONTRACT _____
OWDA PROJECT No. _____ DATE _____
Description of Change: _____

The time provided for completion in the contract for the above items is (increased/decreased) by ____ calendar days.

RECOMMENDED BY: _____ DATE: _____
(Engineer)
APPROVED BY: _____ DATE: _____
(Recipient)
ACCEPTED BY: _____ DATE: _____
(Contractor)

(Company)

		OWDA APPROVAL	
Original Contract Amt		The above proposal is hereby accepted and I recommend that it be approved and made a part of the contract noted above. The approval does not constitute an increase in the total loan amount, but represents approval for the work.	
Previous Changes (+ / --)			
This Change (+ / --)			
Adjusted Contract Amt			
Ohio EPA Acceptance		Chief Engineer	
Date		Date	

CHANGE ORDER INSTRUCTIONS:

All Change Orders for this work, regardless of costs and whether Water Pollution Control Loan Fund (WPCLF) or Water Supply Revolving Loan Account (WSRLA) funding will be used to finance the changes, must be submitted to Ohio EPA for review.

Changes Requiring Prior Approval

Any change which substantially modifies the Project Facilities as specified in the Ohio EPA approved Facilities Plan and Final Permit to Install or Final Plan Approval (when applicable) or alters the direct or indirect impact of the Project Facilities upon the environment must be incorporated into a Change Order. One copy of the Change Order prior to execution is to be submitted to Ohio EPA for review and prior approval of the acceptability of the change. "Prior to execution" means before the Change Order is signed by the Owner.

Ohio EPA will review the Change Order and inform the Owner of the technical, environmental and operational acceptability of the change, and give the Owner permission to proceed with the proposed work.

All Other Changes

Change Orders not requiring prior approval as described above must be submitted to Ohio EPA within one (1) month of the time at which they are approved by the Owner. All change orders must be submitted electronically to dedicated change order email addresses for WPCLF and WSRLA projects.

Change Order Approval Process

After the Change Order is executed, one (1) copy of the Change Order, including the supporting documentation, is to be sent electronically to Ohio EPA for final review.

The dedicated e-mail address for the electronic submittal of WPCLF Change Orders is EPAWPCLFCO@epa.ohio.gov.

The dedicated e-mail address for the electronic submittal of WSRLA Change Orders is EPAWSRLACO@epa.ohio.gov.

After the Change Order is accepted and eligible costs determined, Ohio EPA will issue a letter informing the Owner and authorizing OWDA to disburse funds from Project Contingency for the work. The OEPA letter will be sent electronically along with a PDF of the WPCLF/WSRLA Change Order form which will be signed by all parties including Ohio EPA and OWDA.

Payments for Change Order Work

The Owner is precluded from submitting to the OWDA payment requests for Eligible Project Costs associated with the Change Orders until such time as the Ohio EPA's approval of the Change Orders has been obtained.



November 3, 2022

MEMORANDUM

SUBJECT: Build America, Buy America Act Implementation Procedures for EPA Office of Water Federal Financial Assistance Programs

FROM: Radhika Fox
Assistant Administrator

A handwritten signature in dark ink, appearing to be "R. Fox", is placed to the right of the "FROM:" line.

TO: EPA Regional Water Division Directors, Regions I – X
EPA Office of Water Office Directors

OVERVIEW

The Biden-Harris Administration recognized the Nation's critical need for infrastructure investment, championing the Bipartisan Infrastructure Law (BIL), which Congress passed on November 15, 2021 (also known as the Infrastructure Investment and Jobs Act (IIJA)). The BIL will provide an unprecedented level of federal investment in water and wastewater infrastructure in communities across America.

In Title IX of the IIJA, Congress passed the Build America, Buy America (BABA) Act, which establishes strong and permanent domestic sourcing requirements across all Federal financial assistance programs for infrastructure. The U.S. Environmental Protection Agency (EPA) Office of Water is honored to help lead the implementation of these provisions and is proud of its near decade of successful implementation of the American Iron and Steel (AIS) provisions for its flagship water infrastructure programs.

This is a transformational opportunity to build a resilient supply chain and manufacturing base for critical products here in the United States that will spur investment in good-paying American manufacturing jobs and businesses. EPA's efforts to implement BABA will help cultivate the domestic manufacturing base for a wide range of products commonly used across the water sector but not currently made domestically. This will take time, and flexibility will be important to ensure that EPA can leverage critical water investments on time and on budget to protect public health and improve water quality.

IMPLEMENTATION

Recognizing the opportunity and need for BABA implementation guidance, the Made in America Office (MIAO) of the Office of Management and Budget (OMB) published [Initial Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure](#) (OMB Guidance M-22-11) on April 18, 2022. The guidance provides government-wide implementation direction for all Federal financial assistance programs for infrastructure. Despite the extensive guidance developed by MIAO, EPA's Office of Water infrastructure investment programs have received many questions that were not addressed in OMB Guidance M-22-11 or that require further clarification for EPA water infrastructure programs. The following questions and answers serve to supplement OMB Guidance M-22-11 with implementation procedures specific to EPA's relevant water infrastructure programs.

Section 70914(a) of the IIJA states when a Buy America preference under BABA applies: "Not later than... [May 14, 2022], the head of each Federal agency shall ensure that none of the funds made available for a Federal financial assistance program for infrastructure...may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States." Therefore, Federal financial infrastructure investments obligated on or after May 14, 2022, must comply with the BABA requirements. Absent a waiver, all iron, steel, manufactured products, and construction materials permanently incorporated into an infrastructure project subject to the BABA requirements must be produced in the United States. For many of EPA's Office of Water infrastructure investment programs, the vast majority of products permanently incorporated into construction, maintenance, or repair projects must comply with the BABA requirements, with the exception of select construction materials (cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives), which are specifically excepted by the BABA statute.

EPA's Office of Water implements many infrastructure investment programs subject to BABA requirements, including the following:

- Alaska Native Villages and Rural Communities Water Grant Program (ANV) (and any associated Interagency Agreements with the Indian Health Service)
- Clean Water and Drinking Water State Revolving Fund Programs (CW and DWSRF)
- Clean Water and Drinking Water Grants to U.S. Territories and the District of Columbia
- Clean Water Indian and Drinking Water Tribal Infrastructure Grant Set-aside (and any associated Interagency Agreements with the Indian Health Service)
- Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA) Programs
- Congressionally Directed Spending/Community Project Funding (also known as Community Grants)
- Geographic Programs¹
- Gulf Hypoxia Program
- National Estuaries Program (CWA Section 320)

¹ Geographic Programs include: Great Lakes Restoration Initiative, Chesapeake Bay, San Francisco Bay, Puget Sound, Long Island Sound, Gulf of Mexico, South Florida, Lake Champlain, Lake Pontchartrain, Southern New England Estuaries, Columbia River Basin, Pacific Northwest

- 319 Nonpoint Source Management Program Implementation
- Reducing Lead in Drinking Water Grant Program (SDWA §1459B)
- Assistance for Small and Disadvantaged Communities Grants: Small, Underserved, and Disadvantaged Community Grant Program (SUDC), Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) and Drinking Water Infrastructure Resilience & Sustainability (SDWA §1459A)
- Sewer Overflow and Stormwater Reuse Municipal Grants (OSG)
- USMCA Implementing Legislation (Section 821 and Title IX, USMCA Supplemental Appropriations, 2020)
- U.S.-Mexico Border Water Infrastructure Program
- Voluntary School and Child Care Program Lead Testing and Remediation Grant Program (SDWA 1464(d))
- Water Infrastructure Finance and Innovation Act (WIFIA)

The questions and answers in this document apply to the implementation of BABA requirements for the Office of Water infrastructure programs listed above unless superseded by regulation, statute, or other applicable guidance. For many of the programs listed above which did not have domestic preference requirements prior to BABA, additional implementation details are pending or may be developed after the issuance of these procedures. In addition, EPA notes that more direction will be helpful to inform the determination and definition of domestic content in manufactured goods. Supplemental guidance on these and other issues, from either OMB or EPA, may be forthcoming. These implementation procedures may also apply to additional, unlisted EPA programs which may be required to apply BABA subsequent to publication of this memorandum (e.g., future funding programs which have been authorized, but not yet appropriated).

For more information on the BABA requirements, visit the EPA Office of Water’s dedicated website – <https://www.epa.gov/cwsrf/build-america-buy-america-baba> – or contact your funding authority (such as your grants officer, portfolio manager, or state contact). For information on approved waivers, visit <https://www.epa.gov/cwsrf/build-america-buy-america-baba-approved-waivers>. You may also email questions to BABA-OW@epa.gov.

This Implementation Procedures document is organized to provide responses to questions in the following topic areas:

- Section 1: General 4
- Section 2: Product Coverage 5
- Section 3: Co-funding 9
- Section 4: Waivers 10
- Section 5: Documenting Compliance 12
- Section 6: Programs with American Iron and Steel Requirements 16
- Section 7: Program-Specific Issues 17
- Appendix 1: Example Build America, Buy America (BABA) Act Construction Contract Language 22
- Appendix 2: Example Build America, Buy America (BABA) Act Assistance Agreement Language 23

QUESTIONS AND ANSWERS

SECTION 1: GENERAL

- Q1.1: Will EPA provide documentation for BABA for bid solicitations and suggested contract language? Will EPA provide suggested language for Assistance Agreements?
 - A1.1: See Appendix 1, which includes suggested language for construction contracts which addresses the BABA requirements. In addition to the language suggested in Appendix 1, EPA also recommends that assistance recipients prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the certifications are sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

All Federal Financial infrastructure assistance agreements subject to BABA must have a clause requiring compliance with the requirements. See Appendix 2 for example assistance agreement language.
- Q1.2: Would federally-financed infrastructure projects outside of the United States need to comply with the BABA requirements?
 - A1.2: No. According to the OMB Guidance (M-22-11), a “project” is defined as “...any activity related to the construction, alteration, maintenance, or repair of infrastructure in the United States.” Therefore, the BABA requirements are not implicated for infrastructure projects occurring outside of the United States, such as projects funded through the United States-Mexico-Canada Agreement with infrastructure activities occurring in Mexico or Canada (that is, outside the United States).
 -
- Q1.3: If most of the project is BABA compliant, and a small portion is not, can an assistance recipient self-fund (i.e., paying with non-federal dollars) the non-compliant products?
 - A1.3: Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. All iron, steel, manufactured products, and construction materials used in a project must meet the BABA requirements unless waived. Absent a waiver, there is no “small portion” or product that does not need to satisfy the BABA requirements unless the requirements are waived (or specifically excluded as is the case for cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products). An assistance recipient may request a waiver or inquire as to whether a broad waiver, such as a *de minimis* waiver, might apply.

- Q1.4: How do international trade agreements affect the implementation of the BABA requirements?
 - A1.4: The BABA requirements apply in a manner consistent with United States obligations under international trade agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to these trade agreements. In general, assistance recipients are not signatories to such agreements, so these trade agreements have no impact on BABA implementation. In the few instances where such an agreement applies to a municipality, that municipality is responsible for determining its applicability and requirements and communicating with the funding authority (such as EPA and/or a state) on the actions taken to comply with BABA.

SECTION 2: PRODUCT COVERAGE

- Q2.1: For products made of iron and steel, what is the difference between predominantly and primarily iron and steel?
 - A2.1: EPA considers the terms “predominantly” and “primarily” to be interchangeable, such that a product is considered predominantly (or primarily) iron and steel if it contains greater than 50 percent iron and steel by material cost.
- Q2.2: What is the definition of construction materials (with examples)?
 - A2.2: From OMB Guidance M-22-11: “construction materials” include an article, material, or supply (other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; aggregate binding agents or additives; or non-permanent products) that is or consists primarily of:
 - non-ferrous metals,
 - plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), (including optic glass),
 - lumber, and
 - drywall.

For example, a plate of glass would be a construction material under BABA, but a framed window that incorporates the glass into a frame would be a manufactured product. Another common construction material for water infrastructure projects would be polyvinyl chloride (PVC) pipe and fittings. However, if PVC components are incorporated into a more complex product such as instrumentation and control equipment or a water treatment unit, those items would be manufactured products.

- Q2.3: What are manufactured products (with examples)?
 - A2.3: From OMB Guidance M-22-11: “...all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of

the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation...”

The manufactured products category would cover the majority of potential water infrastructure products, including complex products made up of a variety of material types and components. For water infrastructure projects, common manufactured products would include, but not be limited to, pumps, motors, blowers, aerators, generators, instrumentation and control systems, gauges, meters, measurement equipment, treatment equipment, dewatering equipment, actuators, and many other mechanical and electrical items.

- Q2.4: Which category will valves fall under for BABA? Will it differ from the American Iron and Steel (AIS) requirements?
 - A2.4: For programs that are subject to BABA and AIS (SRF, WIFIA, and Community Project Funding), projects using valves should classify them as iron and steel products under BABA as long as their material cost is made up of more than 50 percent iron and/or steel. Valves with 50 percent or less iron and/or steel by material cost would be considered manufactured products under the BABA requirements.

In accordance with OMB Guidance M-22-11, an article, material, or supply should be classified into only one of the three categories: iron and steel, manufactured products, or construction materials. Under the AIS requirements, all valves made primarily of iron and steel (that is, those with iron and/or steel material cost greater than 50 percent) must comply with the AIS requirements. For BABA, EPA interprets Section IV of OMB Guidance M-22-11 to mean that iron and steel products are those items that are primarily iron and steel, the same as for the AIS requirements.

- Q2.5: Does EPA have a list of products to be classified as “Iron and Steel” under BABA?
 - A2.5: Although this list is not comprehensive, the following products were classified as AIS products if made primarily (more than 50 percent) of iron and/or steel by materials cost (for programs subject to both AIS and BABA, this list would be equivalent for “iron and steel” items or products under either requirement):

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Lined and Unlined Pipe	Lined and Unlined Fittings	Tanks
Flanges	Pipe Clamps and Restraints	Structural Steel
Valves	Hydrants	Pre-Cast, Iron/Steel Reinforced Concrete (of all types, regardless of iron/steel content percentage)
Manhole Covers and other Municipal Castings	Access Hatches	Ballast Screens
Iron or Steel Benches	Bollards	Cast Bases
Cast Iron Hinged Hatches	Cast Iron Riser Rings	Catch Basin Inlets

Cleanout/Monument Boxes	Construction Covers and Frames	Curb and Corner Guards

Products likely made “primarily” of iron and steel to be classified as <u>Iron and Steel</u> under BABA		
Curb Boxes	Curb Openings	Curb Stops
Detectable Warning Plates	Downspout Shoes	Drainage Grates
Drainage Grate Frames and Curb Inlets	Inlets	Junction Boxes
Lampposts	Manhole Rings and Frames	Manhole Risers
Meter Boxes	Service Boxes	Steel Hinged Hatches
Steel Riser Rings	Trash Receptacles	Tree Grates
Tree Guards	Trench Grates	Valve Boxes
Valve Box Covers and Risers	Access Ramps	Aeration Pipes and Fittings (separate from aeration/blowers)
Angles	Backflow Preventers/Double Check Valves	Baffle Curtains
Iron or Steel Bar	Bathroom Stalls	Beam Clamps
Cable Hanging Systems	Clarifier Tanks	Coiled Steel
Column Piping	Concrete Reinforcing Bar, Wire, and Fibers	Condensate Sediment Traps
Corrugated Pipe	Couplings	Decking
Digester Covers	Dome Structures	Door Hardware
Doors	Ductwork	Expansion Joints
Expansion Tanks (diaphragm, surge, and hydropneumatics)	Fasteners	Fencing and Fence Tubing
Fire Escapes	Flanged Pipe	Flap Gates
Framing	Gate Valves	Generic Hanging Brackets
Grating	Ground Testing Boxes	Ground Test Wells
Guardrails	HVAC Registers, Diffusers, and Grilles	Joists
Knife Gates	Ladders	Lifting Hooks, J-bar, Connectors within, and Anchors for Concrete
Lockers	Man Baskets and Material Platforms	Manhole Steps
Mud Valves	Municipal Casting Junctions	Non-mechanical (aka stationary) Louvers and Dampers
Overhead Rolling Doors/ Uplifting Doors (manual open, no motor)	Pipe Connectors	Pipe Hangers
Pipe Pilings (any type of steel piling)	Pipe Spool (pipe, flanges, connectors, etc.)	Pipe Supports
Pitless Adaptors	Pre-fab Steel Buildings/Sheds (simple structure, unfurnished)	Pre-stressed Concrete Cylinder Pipe (PCCP)
Railings	Reduced Pressure Zone (RPZ) Valves	Roofing
Service Saddles	Sheet Piling	Sinks (not part of eyewash systems)
Solenoid Valves	Stairs	Static Mixers
Stationary Screens	Surface Drains	Tapping Sleeves
Telescoping Valves	Tipping Buckets	Trusses
Tubing	Valve Stem Extensions	Valve Stems (excluding handwheels and actuators)

Wall Panels	Wall Sleeves/Floor Sleeves	Welding Rods
Well Casing	Well Screens	Wire
Wire Cloth	Wire Rod	Wire Rope and Cables

Q2.6: Does EPA have a list of products that could be made “primarily” of iron and steel but would be classified as “manufactured products” under BABA?

A2.6: Although this list is not comprehensive, the following products would be considered “manufactured products” under the BABA requirements, even if the item might be composed primarily of iron and steel by materials cost (Note: These items are not subject to the AIS requirements.):

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Actuator Superstructures/ Support Structures	Aeration Nozzles and Injectors	Aerators
Analytical Instrumentation	Analyzers (e.g., ozone, oxygen)	Automated Water Fill Stations
Blowers/Aeration Equipment	Boilers, Boiler Systems	Chemical Feed Systems (e.g., polymer, coagulant, treatment chemicals)
Chemical Injection Quills	Chemical Injectors	Clarifier Mechanisms/Arms
Compressors	Controls and Switches	Conveyors
Cranes	Desiccant Air Dryer Tanks	Dewatering Equipment
Dewatering Roll-offs	Disinfection Systems	Drives (e.g., variable frequency drives)
Electric/Pneumatic/Manual Accessories Used to Operate Valves (such as electric valve actuators)	Electrical Cabinetry and Housings (such as electrical boxes/enclosures)	Electrical Conduit
Electrical Junction Boxes	Electronic Door Locks	Elevator Systems (hydraulic, etc.,)
Emergency Life Systems (including eyewash stations, emergency safety showers, fire extinguishers, fire suppression systems including sprinklers /piping/valves, first aid, etc.)	Exhaust Fans	Fall Protection Anchor Points
Fiberglass Tank w/Appurtenances	Filters (and appurtenances, including underdrains, backwash systems)	Flocculators
Fluidized Bed Incinerators	Galvanized Anodes/Cathodic Protection	Gear Reducers
Generators	Geothermal Systems	Grinders
Heat Exchangers	HVAC (excluding ductwork)	HVAC Dampers (if appurtenances to aerators/blowers)
HVAC Louvers (mechanical)	Intake and Exhaust Grates (if appurtenances to aerators/blowers)	Instrumentation
Laboratory Equipment	Ladder Fall Prevention Systems	Ladder Safety Posts
Lighting Fixtures	Lightning and Grounding Rods	Mechanical or Actuated Louvers/Dampers
Membrane Bioreactor Systems	Membrane Filtration Systems	Metal Office Furniture (fixed)

Meters (including flow, wholesale, water, and service connection)	Motorized Doors (unit)	Motorized Mixers
Motorized Screens (such as traveling screens)	Motors	Pelton Wheels
Pipeline Flash Reactors (similar to injectors)	Plate Settlers	Precast Concrete without Iron/Steel Reinforcement

Products likely made “primarily” of iron and steel to be classified as <u>Manufactured Products</u> under BABA		
Furnished Pre-fab Buildings (such as furnished with pumps, mechanics inside)	Presses (including belt presses)	Pressure Gauges
Pump Cans/Barrels and Strainers	Pumps	Mechanical Rakes
Safety Climb Cable	Sampling Stations (unless also act as hydrant)	Scrubbers
Sensors	Sequencing Batch Reactors (SBR)	Steel Shelving (fixed)
Slide and Sluice Gates	Spray Header Units	Steel Cabinets (fixed interior/furniture)
Supervisory Control and Data Acquisition (SCADA) Systems	Tracer Wire	Valve Manual Gears, Actuators, Handles
Voltage Transformer	Water Electrostatic Precipitators (WESP)	Water Heaters
Weir Gates		

- Q2.7: Is asphalt paving a covered product under BABA?
 - A2.7: No. EPA interprets Section 70917(c) of the IIJA to exclude asphalt from BABA requirements. Asphalt paving is a type of concrete composed of an aggregate material mixed with a binder (bitumen). EPA considers asphalt concrete to be excluded by section 70917(c) due to its similarities with cement and cementitious materials.

SECTION 3: CO-FUNDING

- Q3.1: If projects are co-funded with funding mechanisms that don’t require BABA, must the entire project comply with BABA?
 - A3.1: Yes. Any project that is funded in whole or in part with federal assistance must comply with the BABA requirements, unless the requirements are otherwise waived. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all the contracts and assistance agreements awarded are closely related in purpose, time, and place. This precludes the intentional splitting of projects into separate and smaller contracts or assistance agreements to avoid BABA’s applicability on some portions of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreements would carry separate requirements.

- Q3.2: How will project requirements be determined for co-funded projects subject to potentially different general applicability/programmatic waiver conditions (such as different adjustment period waivers)?
 - A3.2: OMB Guidance M-22-11 addresses cases with project co-funding from separate programs. EPA would apply the guidance’s “cognizant” program determination to projects that are co-funded with different general applicability/programmatic waivers. For instance, if a project were co-funded between WIFIA and SRF and the majority of the Federal funding for the project is from WIFIA, then WIFIA would be the “cognizant” program for application and determination of waivers. In that case, any conditions from an applicable WIFIA waiver would apply.

SECTION 4: WAIVERS

- Q4.1: Who may apply for a waiver and how do you apply?
 - A4.1: Assistance recipients and their authorized representatives may apply for a project-specific waiver. EPA does not accept waiver requests from suppliers, distributors, or manufacturers unless the assistance recipient endorses and submits the request on its own behalf to the funding authority. In the case where multiple programs are providing federal funds to the project, the assistance recipient should submit the waiver request to the cognizant program, the one providing the greatest amount of federal funds for the project. For information on applying for cost waivers, see questions 4.4 and 4.5. For information on the SRF program roles and responsibilities, see question 7.6.

Project-specific waiver requests should generally include: (1) a brief summary of the project, (2) a description and explanation of the need for the waiver for the product(s) in question, (3) a brief summary of the due diligence conducted in search of domestic alternatives (which could include correspondence between assistance recipient and supplier/distributors), (4) the quantity and materials of the product(s) in question, (5) all engineering specifications and project design considerations relevant to the product(s) in question, (6) the approximate unit cost of items (both foreign and domestic) in addition to an estimated cost of the materials and overall project, (7) the date any products will be needed on site in order to avoid significant project schedule disruptions, and (8) any other pertinent information relevant to EPA’s consideration of the waiver (e.g., if relevant for SRF projects: whether the project is designated as an equivalency project, the date the plans and specifications were submitted to the state, the date of construction initiation, expected date of project completion, any special considerations such as local zoning and building ordinances, seismic requirements, or noise or odor control requirements).

In the case of indirect federal assistance, such as the SRF programs, the state authority reviews and conveys the waiver request to EPA. States should submit waiver requests to the appropriate program waiver request inbox. For SRF projects, please use CWSRFWaiver@epa.gov or DWSRFWaiver@epa.gov.

- Q4.2: Can an assistance recipient request a waiver based on a specification written for a specific brand or model of product (that is, a specification that names a branded item or model)?
 - A4.2: In most cases, performance-based specifications are expected and required for the majority of infrastructure projects funded by EPA's financial assistance programs. In rare cases where "branded" or product-specific sourcing may be included in project specifications, it is suggested that the specifications include the item in question (that is, not simply a catalog page, but also materials of construction, sizing, quantities, and applicable engineering performance design characteristics for the project, etc.) in addition to the standard phrase "or equal." For the purposes of product alternative market research, EPA will evaluate the BABA requirements based on performance-based engineering specifications for the product(s) in question. If the project's specifications do not include performance-based specifications, or at least an "or equal" designation, EPA will base its research on an "or equal" designation using best professional judgment to the extent practicable.
- Q4.3: If a manufactured product is not readily available domestically, will EPA provide short-term "limited availability" product waivers?
 - A4.3: EPA will address the unavailability of domestic products through the waiver process, including potential national short-term waivers for specific products, if appropriate. To the extent practicable and with the intent to maximize domestic market and supply chain development, EPA intends to address issues of broad product unavailability with targeted, time-limited, and conditional waivers, as prescribed in OMB Guidance M-22-11. EPA will follow its robust and thorough product research processes (those put into place for the AIS requirements for the SRF and WIFIA programs and expanded for the new BABA requirements) to identify and determine those products for which proposed national/general applicability waivers may be appropriate.
- Q4.4: What information is needed when applying for a cost waiver under BABA?
 - A4.4: As part of the cost waiver request, the assistance recipient must demonstrate that implementation of the BABA requirements will increase the overall project cost more than 25 percent. Depending on the circumstances of the overall project cost increases, documentation to justify the cost waiver can vary but may include itemized cost estimates or bid tabulations comparing project costs with and without BABA implementation. Assistance recipients should begin assessing the potential cost impacts of the BABA requirements during the design phase of a project.
- Q4.5: Can administrative costs associated with tracking and verification of certifications be considered when determining if the cost of a project increases by 25 percent or more?
 - A4.5: Yes. Section 70914(b)(3) of the IIJA states that a waiver may be provided if the overall

cost of the project increases by more than 25 percent due to the “inclusion of iron, steel, manufactured products, or construction materials produced in the United States.” EPA interprets this to mean that the “inclusion” of the BABA-covered products could encompass reasonable administrative costs associated with complying with the BABA requirements, such as staff, contractor, and technological resources to collect and track BABA compliance documentation.

- Q4.6: How can assistance recipients and construction contractors address product delivery delays?
 - A4.6: Assistance recipients should reasonably plan for material procurement to account for known potential supply chain issues or extended lead times and shall notify the funding authority well in advance of the issues so that prompt attention can be given to explore options. Where extended lead times for compliant products are impacting project schedules and may significantly impact construction progress, timely communication with the funding agency is important. For products that are unavailable within a reasonable timeframe to meet the objectives and schedule of a project, EPA may consider a non-availability waiver with adequate justification. An assistance recipient would need to apply for the waiver and contact its funding authority (such as EPA and/or a state) to initiate the waiver process.

SECTION 5: DOCUMENTING COMPLIANCE

- Q5.1: Who will be responsible for BABA enforcement?
 - A5.1: Responsibility for BABA implementation applies at all levels, from manufacturers to suppliers and distributors, construction contractors, assistance recipients, and funding authorities.

The manufacturers have responsibility to provide adequate and accurate documentation of the products manufactured. If suppliers and distributors are involved, they are responsible for passing along compliance documentation for products supplied to projects that are subject to the BABA requirements.

The assistance recipient and their representatives are primarily responsible for ensuring the documentation collected for products used on the project is sufficient to document compliance with the BABA requirements.

The funding authority is responsible for providing oversight and guidance as needed to ensure the proper implementation of the requirements. The Uniform Grants Guidance (UGG) (Title 2 of the Code of Federal Regulations (CFR) Part 200) applies to many Federal financial assistance agreements that will include BABA requirements. The general provisions of 2 CFR Part 200 determine the responsible party for the grant funding authority.

For information on SRF program roles and responsibilities, see question 7.6. At all levels, where fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888- 546-8740

or OIG_Hotline@epa.gov. More information can be found at this website:
<http://www.epa.gov/oig/hotline.htm>.

- Q5.2: When will the BABA requirements be assessed for compliance? Do assistance recipients need to have waivers for potential non-domestic products before assistance agreements are in place, at the time products are procured or products are incorporated into the project (i.e., used)?
 - A5.2: Compliance is assessed where the domestic product is used (or installed) at the project site. Proper compliance documentation, whether it is a BABA certification letter or a waiver, should accompany a product prior to its “use”, in accordance with Section 70914(a) of IIJA. This may occur prior to assistance agreements being in place but is not necessary. Additionally, communication of BABA requirements through appropriate Terms and Conditions in financial assistance agreements and in project solicitation and contract documents is key in ensuring all parties involved are informed of the requirements for the project before construction is underway.
- Q5.3: How can product compliance with the BABA requirements be demonstrated?
 - A5.3: Assistance recipients and their representatives should ensure that the products delivered to the construction site are accompanied by proper documentation that demonstrate compliance with the law and be made available to the funding authority upon request. The documentation may be received and maintained in hard copy, electronically, or could be embedded in construction management software. The use of a signed certification letter for the project is the most direct and effective form of compliance documentation for ensuring products used on site are BABA-compliant prior to their installation; however, other forms of documentation are also acceptable as long as collectively, the following can be demonstrated:
 - (1) Documentation linked to the project. For example, this can be in the form of the project name, project location, contract number, or project number.
 - (2) Documentation linked to the product used on the project. For example, description of product(s) (simple explanation sufficient to identify the product(s)), or an attached (or electronic link to) purchase order, invoice, or bill of lading.
 - (3) Documentation includes statement attesting that the products supplied to the assistance recipient are compliant with BABA requirement. Reference to the Infrastructure Investment and Jobs Act (“IIJA”) or the Bipartisan Infrastructure Law (BIL) are also acceptable. For iron and steel items under BABA, references to the American Iron and Steel (AIS) requirements are also acceptable and reciprocal with BABA for such items.
 - (4) Documentation that manufacturing occurred in the United States, which could include, for example, the location(s) of manufacturing for each manufacturing step that is being certified. It is acceptable for manufactured products to note a single point of manufacturing, documenting that the final point of manufacturing is in the United States. Note that each BABA category may require different determinations for

compliance.

- (5) Signature of company representative (on company letterhead and signature can be electronic). The signatory of the certifying statement affirms their knowledge of the manufacturing processes for the referenced product(s) and attests that the product meets the BABA requirements.

In addition to compliance documentation, assistance recipients or their representatives should also conduct a visual inspection of the product when it arrives to the project site, especially for iron and steel products which are often stamped with the country of origin. (Note: A country of origin stamp alone is not sufficient verification of compliance with BABA and assistance receipts should not rely on it to ensure compliance.)

EPA may develop alternative procedures for demonstrating compliance. Additional project- or program-specific instructions may be developed on a case-by-case basis in order to meet individual circumstances.

- Q5.4: Will EPA provide a form or template for tracking and documenting compliance?
- A5.4: EPA does not require a specified format for tracking or documenting compliance. Assistance recipients are free to develop any system (from simple to complex software) for tracking items used on the project and the accompanying compliance documentation, e.g., certification letters, applicable waivers, if it helps with implementation and compliance. Elements that may help with keeping track of compliance may include: product description, quantity required/used, product category (i.e., iron and steel, manufactured product, or construction material), status of obtaining certification letter, product cost, and whether the item might qualify as *de minimis*, or qualify under another applicable waiver.
- Q5.5: If a manufacturer claims to comply with the Buy American Act, does it also comply with BABA?
 - A5.5: No. With the exception of the AIS requirements – which EPA interprets to be equivalent to the “iron and steel” requirements under BABA – EPA does not have an interpretation about the comparability of other domestic preference requirements relative to BABA. Any products that are to be certified as compliant with BABA should include a specific reference to the BABA requirements and appropriate attestation from a responsible manufacturing company official. See Question 5.3 for EPA’s recommendations for BABA certification letters.
- Q5.6: How will assistance recipients manage certification letters for hundreds, possibly thousands of products?

A5.6: EPA recognizes that the new BABA requirements will cover most products used in typical water and wastewater infrastructure projects, and that the number of items which may require certification at large and/or complex projects may reach several hundred. EPA is concerned about the potential administrative burden that this would place on assistance recipients. EPA recommends that projects with a high number of potentially covered

products meet with their funding authority about potential compliance strategies to minimize burden and streamline compliance activity. Assistance recipients should prepare contract bid solicitation documents with a statement for the consulting engineers and construction firms as follows: “By signing payment application and recommending payment, Contractor certifies they have reviewed documentation for all products and materials submitted for payment, and the documentation is sufficient to demonstrate compliance with Build America, Buy America Act requirements.” In most cases, the assistance recipient’s representatives may assume the responsibility for their clients to conduct due diligence on compliance with applicable domestic preference requirements.

- Q5.7: Who is responsible for documenting the 55 percent content requirement for manufactured products under BABA? What if the final manufacturer cannot trace or verify domestic origin for all components?
 - A5.7: The manufacturer who signs a certification letter is responsible for documenting compliance with any of the three categories of products (iron and steel, manufactured products, or construction materials). For manufactured products, BABA requires that greater than 55 percent of the total cost of all components of the manufactured product be from domestic sources. EPA recommends that the certification letter for manufactured products document whether the item passes the content test in the final product along with a statement attesting to compliance with the BABA requirements for manufactured products.
- Q5.8: How do final product fabricators document compliance when the final step of manufacturing may be simply assembling components?
 - A5.8: It is acceptable, in many cases, especially for highly complex manufactured products that utilize many sub-components, for the final point of assembly to certify without using a “step certification” process. Multiple certifications (i.e., step certifications) or a singular certification can be used for a product, as long as the certifying official is willing to attest to the product’s compliance with BABA requirements at all stages of manufacturing.
- Q5.9: Will Material Test Reports be acceptable in lieu of a BABA certification for iron and steel?
 - A5.9: Material Test Reports (MTRs, commonly referred to as “Mill Certifications” or “Mill Certs”) provide the chemical composition of steel and iron from a mill or foundry. If an MTR accompanies the delivery of steel or iron to a project site with an invoice or bill of lading, EPA will consider it sufficient to demonstrate compliance (equivalent to a certification letter) as long as the MTR includes a manufacturer representative’s signature in addition to the location (city and state) of the mill/foundry. It is common for MTRs to be the first letter in a “step certification” if the product is further fabricated or painted, etc., by another manufacturer.
- Q5.10: Can a manufacturer use a fillable certification letter for products?

- A5.10: EPA recommends that certifications be signed by representatives of the manufacturing entity. EPA does not oppose manufacturers using forms to internally develop letters within their company, thereby providing signed, non-manipulable certification letters to suppliers, distributors, and/or assistance recipients. A fillable form that can be changed by someone outside of the manufacturer after signature does not demonstrate compliance and may create compliance concerns for the manufacturer or assistance recipient.
- Q5.11: Are product certifications from suppliers and distributors allowed?
 - A5.11: EPA recommends that representatives of product manufacturers certify compliance and discourages suppliers and distributors from creating certification letters. EPA does not rule out the possibility that a third-party certification process, such as a certification by a distributor, may be viable. However, EPA is currently not aware of a system or proposed system that meets the EPA's recommendations for documentation of product certification.
- Q5.12: How long should assistance recipients keep compliance documentation?
 - A5.12: Assistance recipients should apply recordkeeping requirements for the project according to the procedures dictated by the funding authority. For most EPA grant programs, this is prescribed in the UGG at 2 CFR 200.334-200.338; e.g., the SRF programs require a minimum of three years. Other funding programs may require longer documentation retention periods.

SECTION 6: PROGRAMS WITH AMERICAN IRON AND STEEL REQUIREMENTS

- Q6.1: Does BABA supersede the American Iron and Steel (AIS) Requirements?
 - A6.1: The BABA requirements for items considered "iron and steel" are equivalent to those for covered iron and steel products under the AIS requirements in the Clean Water Act and the Safe Drinking Water Act. These requirements apply to the CWSRF, DWSRF, WIFIA, and Water infrastructure Community Grants. BABA includes a "Savings Provision" (Section 70917(b)) that states that BABA does not affect existing domestic content procurement preferences for infrastructure projects funded by Federal financial assistance programs that meet the requirements of section 70914. EPA views the AIS requirements as meeting the "iron and steel" product requirements of BABA Section 70914, as they both include the key requirement that items made of iron and steel be wholly manufactured in the United States from the point of melting and/or pouring the iron or steel components through final manufacturing step. Because of the "Savings Provision" of Section 70917, the AIS requirements satisfy the "iron and steel" requirements of BABA. For the programs that have AIS requirements, EPA intends to implement BABA requirements the same way for iron and steel items as it has done for AIS products.

- Q6.2: For iron and steel products, does a manufacturer need to demonstrate compliance from initial melting through the finished product?
 - A6.2: For iron and steel products, the BABA requirements are the same as the existing AIS requirements, in that all of the iron and steel in a covered product (that is, the product is comprised of more than 50 percent iron and steel by material cost) must be melted and poured in the United States and all subsequent manufacturing processes (such as grinding, rolling, bending, reheating, and casting) must occur in the United States.

Q6.3: Will EPA apply the same manufacturing standards for BABA iron and steel products as for the American Iron and Steel (AIS) requirements?

- A6.3: Yes. For AIS, EPA did not require raw materials used in the production of steel or iron to be domestically sourced. For BABA, EPA interprets the requirements to be the same. Hence, like AIS, raw materials in the production of iron and steel subject to BABA requirements would not need to be domestically sourced. The key step for both AIS and BABA domestic iron and/or steel production is the melting/pouring (that is, the location of the furnace), which must be in the United States.
- Q6.4: Will the certification process be similar to the process established for the American Iron and Steel requirements?
 - A6.4: EPA expects the certification process for the BABA requirements to be very similar to that established for the AIS requirements. For iron and steel products, the process should remain the same for AIS and BABA. EPA recommends for manufactured products and for construction materials that certification letters include direct reference to the product/material content requirements under BABA, in addition to an affirmative statement verifying that the product meets the BABA requirements.
- Q6.5: Will duplicate certification letters be required for AIS and BABA for iron/steel products?
 - A6.5: No. Compliance with BABA requirements will be sufficient to demonstrate compliance with AIS requirements for iron and steel products. If a project is subject to BABA, the only demonstration of compliance necessary is with the BABA requirements, of which the iron and steel requirements are equivalent to those of the AIS statutory requirements: the iron or steel in a product made primarily or predominantly of iron and steel (comprising more than 50 percent iron and steel by material cost) must be melted and/or poured in the United States and all subsequent manufacturing processes must occur in the United States.

SECTION 7: PROGRAM-SPECIFIC ISSUES

- Q7.1.: How do the BABA requirements apply to Community Grants?
 - A7.1: The Community Project Funding/Congressionally Directed Spending grants for the construction of drinking water, wastewater, and stormwater infrastructure and for water

quality protection are subject to the requirements specified in the explanatory statement accompanying the Consolidated Appropriations Act (Explanatory Statement for Division G of P.L. 117-13, the Consolidated Appropriations Act of 2022). The explanatory statement asserts: “Applicable Federal requirements that would apply to a Clean Water State Revolving Fund or Drinking Water State Revolving Fund project grant recipient shall apply to a grantee receiving a CPF grant under this section.” Therefore, the federally funded Community Project Funding/Congressionally Directed Spending grants are subject to the same requirements that apply to CWSRF or DWSRF projects, including BABA and AIS requirements. See also A1.2.

- Q7.2: Should SRF projects covered by the BABA SRF Projects Design Planning Adjustment Period Waiver follow the same procedures for demonstrating compliance as outlined for American Iron and Steel requirements?
 - A7.2: Yes. The SRF Design Planning Adjustment Period waiver does not waive the iron and steel requirements under BABA. The SRF programs have existing domestic preference requirements for SRF projects under CWA Section 608 and SDWA Section 1452(a)(4) (AIS requirements) to use iron and steel products that are produced in the United States. Sections 70917(a) and (b) of BIL explain the application of BABA to existing domestic preference requirements. Specifically, the savings provision in Section 70917(b) states that existing domestic preference requirements that meet BABA requirements are not affected by BABA. The statutory AIS requirements were existing at the time BABA became law and satisfy the BABA iron and steel requirements. Therefore, the statutory AIS requirements that have previously applied to SRF-funded projects will continue to do so, and compliance with AIS requirements will satisfy the BABA iron and steel requirements. Demonstration of compliance for iron and steel products will follow the AIS implementation policies for projects subject to the waiver.
- Q7.3: For SRF programs, is BABA considered a federal cross-cutting authority? (i.e., do “equivalency” rules apply?)
 - A7.3: Yes, BABA is considered a federal cross-cutting requirement that applies to SRF assistance equivalent to the federal capitalization grant (i.e., “equivalency” projects). EPA’s SRF regulations at 40 CFR 35.3145 and 35.3575 require states and recipients of SRF funds equivalent to the amount of the federal capitalization grant to comply with federal cross-cutting requirements. Section 70914 of the IIJA, which states when a Buy America preference applies, explains that “none of the funds made available for a Federal financial assistance program for infrastructure...may be obligated for a project unless all of the iron, steel, manufactured products, and construction materials used in the project are produced in the United States.” Therefore, BABA only applies to projects funded in an amount equivalent to the federal capitalization grant and not to those projects receiving funds in excess of the capitalization grant (i.e., “non-equivalency” projects). (Note: The AIS requirements continue to apply for all SRF projects, including non-equivalency projects, and all WIFIA and Community Grant projects, because equivalency does not apply.)

- Q7.4: Do the BABA requirements apply to Drinking Water State Revolving Fund set-asides?
 - A7.4: Due to requirements related to the deposit of funds in the DWSRF program, almost all of the funds used to conduct set-aside activities are Federal dollars. Therefore, Federal cross-cutting requirements must be applied to all set-aside activities. However, in the case of most set-aside activities, the cross-cutting requirements will not be implicated because of the nature of the activities conducted under the set-asides. Because the BABA requirements only apply to infrastructure, and infrastructure typically is not an eligible set-aside expenditure (with one potential exception being loans for incentive-based source water protection measures under the Local Assistance and Other State Programs Set-Aside), the BABA requirements will not apply to most set-aside activities.
- Q7.5: What if an SRF project is refinanced using Federal financial assistance on or after May 14, 2022?
 - A7.5: If an SRF project began construction, financed from another funding source, prior to May 14, 2022, but is refinanced through an assistance agreement executed on or after that date, BABA requirements will apply to all construction that occurs on or after May 14, 2022, through completion of construction, unless a waiver applies. There is no retroactive application of the BABA requirements where a refinancing occurs for an SRF project that has completed construction prior to May 14, 2022. (Note: If SRF funding is used for the refinancing, the AIS requirements may still apply depending on the timing of construction.)
- Q7.6: What are the roles and responsibilities for SRF programs for BABA implementation?
 - A7.6: Implementation of the BABA requirements for the State Revolving Fund programs will continue the roles and responsibilities from the successful AIS implementation process.

As with AIS, it is both the assistance recipient's and the state's responsibility to ensure compliance with the BABA requirements. The state is the recipient of a federal capitalization grant and must comply with all grant conditions, including a condition requiring adherence to BABA requirements.

Consequently, states are strongly advised to conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance. In EPA's experience, most states conduct periodic site visits and arrange timely meetings with funded projects. Observed best practices typically include a meeting early in the process (sometimes before bid and usually prior to commencing construction) and at least one project site visit during the construction process. Assistance recipients must maintain documentation of compliance with the BABA requirements, as explained in question 5.3. The documents must be kept by the assistance recipient and should be reviewed by the state during project reviews.

The state's role in the waiver process is to review any waiver requests submitted to the state to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with

the assistance recipient to help obtain complete information. Question 4.1 explains the information needed by EPA to expediently review a waiver request.

In order to implement the BABA requirements, EPA has developed an approach for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow states, on behalf of the assistance recipients, to apply for waivers of the BABA requirements directly to EPA Headquarters. Only waiver requests received and/or endorsed from states will be considered. Pursuant to BABA, EPA has the responsibility to make findings as to the issuance of waivers to the BABA requirements.

Step-by-step SRF Waiver Process

The waiver process begins with the assistance recipient. To fulfill the BABA requirements, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American-made iron and steel, manufactured goods, and construction materials. It is essential that the assistance recipient include the BABA terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 2 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three statutory conditions is demonstrated to EPA and approved.

To apply for a project-specific waiver, the assistance recipient should email the request in the form of a Word document (.doc) or editable PDF (.pdf) to the funding program. It is strongly recommended that each state identify a person or persons for BABA communications. The state designee(s) will review the application for the waiver and determine whether the necessary information has been included (Note: More information may be provided in the future regarding what information is required to be included in waiver requests). Once the waiver application is complete, the designee (State) will forward the application to the EPA for review.

Evaluation by EPA

After receiving an application for waiver of the BABA requirements and ensuring sufficient information was provided, EPA will publish the request on its website for 15 days and receive public comment. EPA will then determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the state designee whether a waiver request has been approved or not approved as soon as such a decision has been made. Granting such a waiver is a four-step process:

1. Research – After receiving an application for a waiver, EPA will perform market research to determine whether the iron, steel, manufactured goods, or construction materials are available domestically.
2. Posting – After research, if no domestic product has been identified, EPA is required to

publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at:
<https://www.epa.gov/cwsrf/build-america-buy-america-baba-waivers-open-public-comment>.

3. Evaluation – After receiving an application for waiver of the BABA requirements, EPA will determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver to determine whether or not to grant the waiver.

4. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program and post the signed waiver on the Agency's website. The assistance recipient should keep a copy of the signed waiver in its project files.

(Note: Additional steps may be required in the future regarding the waiver process depending on additional guidance from OBM) APPENDIX 1



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: f (Andrew D. Sawyers, Director C.
l) Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with “split” funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which

case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

12) What does the term ‘primarily iron or steel’ mean?

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does ‘produced in the United States’ mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components

do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of ‘municipal castings’?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is ‘structural steel’?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a ‘construction material’ for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a ‘construction material’ for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters,

heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: <http://www.epa.gov/oig/hotline.htm>.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to the EPA for review.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to

determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm
2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.
3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests - Does the waiver request include the following information? - Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products - Relevant excerpts from the bid documents used by the contractors to complete the comparison - A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market - Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests - Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? - Supplier information or other documentation indicating availability/delivery date for materials - Project schedule - Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials - Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers? - Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information) - Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: - Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State - Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States - Correspondence with construction trade associations indicating the non-availability of the materials - Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

**American Iron & Steel (AIS) Requirement of the Consolidated Appropriations Act of 2014
(Public Law 113-76)**

Q&A Part 2

PRODUCT QUESTIONS

1. Q: Do all fasteners qualify for de minimis exemption?

A: No. There is no broad exemption for fasteners from the American Iron and Steel (AIS) requirements. Significant fasteners used in SRF projects are not subject to the de minimis waiver for projects and must comply with the AIS requirements. Significant fasteners include fasteners produced to industry standards (e.g., ASTM standards) and/or project specifications, special ordered or those of high value. When bulk purchase of unknown-origin fasteners that are of incidental use and small value are used on a project, they may fall under the national de minimis waiver for projects. The list of potential items could be varied, such as big-box/hardware-store-variety screws, nails, and staples. The key characteristics of the items that may qualify for the de minimis waiver would be items that are incidental to the project purpose (such as drywall screws) and not significant in value or purpose (such as common nails or brads).

EPA also clarifies that minor components of two listed products – valves and hydrants -- may not need to meet the AIS requirements if the minor components compromise a very small quantity of minor, low-cost fasteners that are of unknown origin.

2. Q: Does PCCP pipe have to be domestically produced?

A: Yes. Pre-stressed concrete cylinder pipe (PCCP) or other similar concrete cylinder pipes would be comparable to pre-cast concrete which is specifically listed in the Consolidated Appropriations Act of 2014 as a product subject to the AIS requirement.

3. Q: If the iron or steel is made from recycled metals will the vendor/supplier have to provide a certification document certifying that the recycled metals are domestically produced?

A: No. Recycled source materials used in the production of iron and steel products do not have to come from the U.S. Iron or steel scrap, for instance, are considered raw materials that may come from anywhere. While certification is not required for the raw material, EPA does recommend that additional final processing of iron and steel be certified to have occurred in the U.S.

4. Q: Do tanks used for filtration systems, if delivered to the construction site separately and then filled with filtration media onsite, have to be domestically produced?

A: No. Tanks that are specifically designed to be filters, or as parts of a filtration system, do not have to be domestically produced because these parts are no longer simply tanks, even if the filter media has not been installed and will be installed at the project site, as is customary to do for shipping purposes. These parts have only one purpose which is to be housing for filters and cannot be used in another fashion.

5. Q: Can a recipient use non-domestic flanged pipe?

A: No. While the Consolidated Appropriations Act of 2014 does not specifically mention flanged pipe, since it does mention both pipe and flanges, both products would need to be domestically produced. Therefore, flanged pipe would also need to be domestically produced.

6. Q: Can a recipient use non-domestic couplings, expansion joints, and other similar pipe connectors?

A: No. These products would be considered specialty fittings, due to their additional functionality, but still categorized under the larger “fitting” categorization. Fittings are defined as a material that joins pipes together or connects to a pipe (AWWA, The Drinking Water Dictionary, 2000). Therefore, these products must comply with the AIS requirements and be produced domestically.

7. Q: Can a recipient use non-domestic service saddles and tapping sleeves?

A: No. These products are necessary for pipe repair, to tap a water main, or to install a service or house connection. Therefore, they are included under the larger “pipe restraint” category which is a specifically identified product subject to the domestic preference in the Consolidated Appropriations Act of 2014.

8. Q: The AIS guidance does not appear to cover reused items (i.e., existing pipe fittings, used storage tanks, reusing existing valves). How should reused items be addressed?

A: The AIS guidance does not address reuse of items. Reuse of items that would otherwise be covered by AIS is acceptable provided that the item(s) was originally purchased prior to January 17, 2014, the reused item(s) is not substantially altered from original form/function, and any restoration work that may be required does not include the replacement or addition of foreign iron or steel replacement parts. EPA recommends keeping a log of these reused items by including them on the assistance recipient’s de minimis list, and stating therein that these items are reused products. The donation of new items (such as a manufacturer waiving cost for certain delivered items because of concerns regarding the origin of a new product) is not, however, considered reuse.

9. Q: What does “time needed” mean in the AIS guidance, in reference to the definition of “Reasonably Available Quantity”?

A: For considering whether a product would meet reasonably available quantity, “time needed” is based on the construction schedule. If the item is delayed and there is substantial impact on the overall construction schedule, this would not be according to the “time needed.”

10. Q: If a product is not specifically included on the list of AIS covered products, must it comply with AIS?

A: Possibly. The AIS requirements include a list of specifically covered products, one of which is construction materials, a broad category of potential products. For construction materials, EPA’s AIS guidance includes a set of example items that it considers construction materials composed primarily of iron and steel and covered by the Act. This example list in the guidance is not an all-inclusive list of potential construction materials. However, the guidance also includes a list of items that EPA specifically does not consider construction materials, generally those of electrical or complex-mechanical nature. If a product is similar to the ones in the non-construction material list (and it is also not specifically listed by the Act), it is not a construction material. For all other items specifically included in the Act, coverage is generally self-evident.

11. Q: If a listed iron and steel product is used as a part for an assembled product that is non-domestic, do the AIS requirements apply?

A: AIS requirements only apply to the final product as delivered to the work site and incorporated into the project. Other assemblies, such as a pumping assembly or a reverse osmosis package plant, are distinct products not listed and do not need to be made in the U.S. or composed of all U.S. parts. Therefore, for the case of a non-covered product used in a larger non-domestic assembly, the components, even if specifically listed in the Consolidated Appropriations Act, do not have to be domestically produced.

12. Q: Is cast iron excluded from the AIS requirements?

A: No. Cast iron products that fall under the definition of iron and steel products must comply with the AIS requirements.

13. Q: The guidance states that “construction materials” do not include mechanical equipment, but then identifies ductwork as a construction material. Please clarify.

A: Ductwork is not mechanical equipment, therefore it is considered a “construction material” and must comply with the AIS requirements.

14. Q: Do “meters” mentioned in EPA’s guidance as non-construction materials include both flow meters and water meters?

A: Yes. “Meters” includes any type of meter, including: flow meters, wholesale meters, and water meters/service connections.

15. Q: Must coiled steel be domestic?

A: Yes. Coiled steel is an intermediate product used in the production of steel pipe and must come from a U.S. source or subject to a waiver in order to comply with the AIS requirements.

16. Q: Are pig iron, direct reduced iron (DRI), and ingot considered raw materials?

A: No. These are considered intermediate products used in the production of iron or steel and must come from a U.S. source or subject to a waiver in order to comply with the AIS requirements.

17. Q: Can assistance recipients rely on a marking that reads, “Made in the USA,” as evidence that all processes took place in the U.S.?

A: No. This designation is not consistent with our requirements that all manufacturing processes of iron and steel products must take place in the U.S.

18. Q: When determining what constitutes a product made “primarily” of iron or steel, who makes this determination?

A: The manufacturer will show if its product qualifies as primarily made of iron or steel. The recipient should expect the manufacturer to provide documentation/ certification that its product is AIS compliant.

19. Q: Do aerators need to be produced domestically in order to comply with AIS?

A: No. Aerators, similar to pumps, are mechanical equipment that do not need to meet the AIS requirements. “Blowers/aeration equipment, compressors” are listed in EPA’s guidance as non-construction materials.

20. Q: Are Sluice and Slide Gates considered valves?

A: No. Valves are products that are generally encased / enclosed with a body, bonnet, and stem. Examples include enclosed butterfly, ball, globe, piston, check, wedge, and gate valves. Furthermore, “gates” (meaning sluice, slide or weir gates) are listed in EPA’s guidance as non-construction materials.

AIS PROCESS QUESTIONS

21. Q: Will notices of waiver applications be published in the federal register?

A: No. Applications for waivers will be published on EPA’s website (http://water.epa.gov/grants_funding/aisrequirement.cfm). EPA will provide 15 days for open public comment, as noted on the website.

22. Q: Will states be collecting the step certification paper trail, as presented in the AIS guidance?

A. No. Assistance recipients must maintain documentation of compliance with AIS. EPA recommends use of the step certification process. This process is a best practice and traces all manufacturing of iron and steel products to the U.S. If the process is used, the state does not have to collect the documentation. The documents must be kept by the assistance recipient and reviewed by the state during project reviews.

23. Q: Why is it considered a best practice for states to conduct site visits, when it is the assistance recipient's responsibility to meet the AIS requirements?

A: It is both the assistance recipient's and the state's responsibility to ensure compliance with the AIS requirements. The state is the recipient of a federal grant and must comply with all grant conditions, including a condition requiring that the AIS requirements be adhered to. Therefore, it is recommended that states conduct site visits of projects during construction and review documentation demonstrating the assistance recipient's proof of compliance.

24. Q: Please further define the state's role in the waiver process.

A: The state's role in the waiver process is to review any waiver requests submitted to the state in order to ensure that all necessary information has been provided by the assistance recipient prior to forwarding the request to EPA. If a state finds the request lacking, the state should work with the assistance recipient to help obtain complete information.

25. Q: How much time does EPA have to evaluate the waiver during the evaluation step?

A: At a minimum, EPA is required to provide 15 days for open public comment. There is no specific deadline or time limit for EPA to review waiver requests. Each waiver request will come with its own specific details and circumstances and may require a different amount of time for review and analysis. For example, public interest waivers in general may take longer to review than availability waivers which are typically more straightforward. However, EPA understands that construction may be delayed while waiting for a waiver and will make every effort to review and issue decisions on waiver requests in a timely manner.

PROJECT QUESTIONS

26. Q: What if a project is funded by another funding entity (i.e., United States Department of Agriculture – Rural Development) where AIS is not required and begins construction after January 17, 2014 but then applies to the SRF to refinance the project? Are they ineligible?

A: The project is not ineligible. AIS requirements will apply to any construction that occurs after the assistance agreement is signed, through the end of construction. If construction is complete, there is no retroactive application of the AIS requirements.

27. Q: If the assistance recipient can demonstrate through market research that the AIS requirement will exceed the 25 percent cost threshold, is the entire project exempt from the AIS requirement?

A: If the waiver application shows that the inclusion of American iron and steel products causes the entire cost of the project to increase by more the 25 percent, a waiver may be granted for the entirety of the project.

28. Q: Can the recipient use non-SRF funds to pay for the non-compliant item.

A: No. It is not an acceptable to use non-SRF funds to pay for a non-compliant item. The Consolidated Appropriations Act of 2014 requires that all iron and steel products, no matter the source of funding, must be made in the U.S. if SRF funds are used in the project.

29. Q: What constitutes “satisfactory quality” as defined in the AIS guidance, in reference to the availability waiver process.

A: “Satisfactory quality” means the product meets the project design specifications. A waiver may be granted if a recipient determines that the project plans and design would be compromised because there are no American made products available that meet the project design specifications.

30. Q: The guidance states that the AIS requirement applies to any project “funded in whole or in part” by an SRF. Where is this in the Act?

A: The Act states that, “None of the funds made available by a ... [State SRF program] ... shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.” This sentence clearly states that no SRF program may use its funds for a project unless all of the iron and steel products used in the project are made in the U.S. This is true even if only \$1 of SRF funding is used in the project.

31. Q: There is always an expectation on the part of an assistance recipient that the construction phase of a planning and/or design only loan will be funded through the SRF. If the original planning and/or design only loan was executed prior to a January 17, 2014, does this mean the entire project will be exempt from the AIS requirement?

A: If the original loan includes construction, and was executed prior to January 17, 2014, then the AIS provision does not apply to the project. If the original loan was only for planning and/or design, then a written commitment or documented “expectation” is needed to show exemption from the

requirements. Appearance on a priority list in an Intended Use Plan along with written reasonable assurance from the state that the recipient will receive SRF funding for project construction could provide sufficient evidence of “expectation of funding”.

- 32. Q: What if there has been a change order or redesign requiring new plans and specifications to be approved and they were approved after January 17, 2014: does the project now have to comply with AIS?**

A: In most cases, no. Change orders are typically small enough changes that the original plan and specification date will still hold true. For example, if a pipe alignment has to be changed for a block or two due to unforeseen conditions, but new plans and specifications had to be submitted for this section of the project, then that could be considered a minor change. However, if there has been a major redesign, perhaps the whole project had to be redesigned starting from scratch, then the new plans and specification approval date would apply.

- 33. Q: What if the bids on a project with plans and specifications approved before January 17, 2014 but the loan is signed after January 17, 2014 come in low, and there is significant funding remaining in the loan agreement, so the community designs a second project with the remaining funds: does that project have to comply with the AIS requirements?**

A: If the second project is closely related in purpose, place and time to the first project, then the second project would be exempt from the AIS requirements. It is the assistance recipient’s responsibility (with state oversight) to show that a project is closely related, or not, in purpose, place and time.

- 34. Q: What if the assistance agreement was signed after January 17, 2014, state approval of plans for the first phase of the project was in place prior to January 17, 2014, but state approval of the plans for the second phase of the project was received after January 17, 2014?**

A: In such a case, the AIS provision would not apply to the first phase of the project. If the second phase of the project is considered the same project as the first phase, due to its close relation in purpose, place and time, the entire project may be exempt. It is the assistance recipient’s responsibility (with state oversight) to show that phases of a project is closely related, or not, in purpose, place and time.

- 35. Q: Do products purchased through procurement-only contracts have to be comply with AIS?**

A: Yes. For projects funded by SRF, the products procured under any form of contract must comply with AIS. A procurement-only contract generally involves the bulk purchase of common items (such as pipe, concrete, and/or pumps) of independent timing from a set of planned projects. If products which are purchased through a procurement-only contract are being installed under another contract, the procurement-only contract would probably not be considered a separate project in purpose, place and time; and therefore, would have to comply with the AIS requirements.

March 2015

American Iron & Steel Requirement for the Clean Water and Drinking Water State Revolving Funds

Q&A Part 3

*For CWSRF and DWSRF: On **January 17, 2014**, Public Law 113-76, the "Consolidated Appropriations Act, 2014," was enacted and included an American Iron and Steel requirement for the Clean Water and Drinking Water State Revolving Fund programs through the end of fiscal year 2014. Since then, the AIS requirement has continued for both programs, but through different statutes, with a few changes as described in the questions and answers provided below.*

*For CWSRF: On **June 10, 2014**, the Water Resources Reform and Development Act amended the Clean Water Act to include permanent requirements for the use of AIS products in CWSRF assistance agreements. Section 608 of the CWA now contains requirements for AIS that repeat those of the Consolidated Appropriations Act, 2014. All CWSRF assistance agreements must comply with Section 608 of the CWA for implementation of the permanent AIS requirement.*

*For DWSRF: On **December 16, 2014**, the President signed Public Law 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," which provides fiscal year 2015 full-year appropriations through September 30, 2015. This law continues the requirement for the use of AIS products in DWSRF assistance agreements through September 30, 2015.*

CWSRF PROGRAM

- 1. Q: The Water Resources Reform and Development Act amended the Clean Water Act to include permanent requirements for the use of AIS for CWSRF funded assistance agreements. Does the CWA include an exemption for plans and specifications approved prior to the enactment of the legislation similar to the exemption included in the Consolidated Appropriations Act (CAA) 2014?**

A: Yes. The WRRDA amendment to the CWA, which included AIS requirements, included a similar exemption as the CAA 2014. For any CWSRF assistance agreement signed on or after October 1, 2014, if the plans and specifications were approved prior to June 10, 2014 (the enactment of WRRDA), then the project is exempt from AIS requirements. For assistance agreements signed prior to October 1, 2014, the previous dates in the CAA 2014 apply (see March 20, 2014, AIS guidance document).

If a project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the plans and specifications approval date for purposes of this exemption in Section 608 (f).

The following table summarizes AIS exemptions based on the plans and specifications approval date for CWSRF funded projects.

3/16/2015

CWSRF AIS Project Exemption Based on Plans and Specifications Approval Date		
<u>Assistance Agreement Signed:</u>	<u>Exempt from AIS if Plans and Specifications Were Approved Before:</u>	<u>Basis for Exemption:</u>
1/17/2014 through 9/30/2014	4/15/2014	- Consolidated Appropriations Act 2014 - National waiver signed 4/15/2014*
On or after 10/1/2014	6/10/2014	Clean Water Act Section 608

** To be covered by the national waiver, the plans and specifications had to be submitted to the state prior to 1/17/2014*

2. Q: Does the AIS requirement apply to refinanced CWSRF projects?

A: Yes, in some cases. If a project began construction, financed from a non-CWSRF source prior to June 10, 2014, but is refinanced through a CWSRF assistance agreement executed on or after October 1, 2014, AIS requirements will apply to all construction that occurs on or after June 10, 2014, through completion of construction, unless engineering plans and specifications were approved by the responsible state agency prior to June 10, 2014. For CWSRF projects funded on or after October 1, 2014, there is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to June 10, 2014.

DWSRF PROGRAM

3. Q: The Consolidated and Further Continuing Appropriations Act 2015 continues the AIS requirements for DWSRF funded assistance agreements. Does the Act include an exemption for plans and specifications approved prior to the enactment of the legislation, similar to the exemption included in the Consolidated Appropriations Act (CAA) 2014?

A: Yes. The Consolidated and Further Continuing Appropriations Act 2015 includes a similar exemption as the CAA 2014. For any assistance agreement signed on or after December 16, 2014 (the enactment of the Act), if the plans and specifications were approved prior to December 16, 2014, then the project is exempt from the AIS requirements. For assistance agreements signed prior to December 16, 2014, the previous dates in the CAA 2014 apply (see March 20, 2014 AIS guidance document).

If a project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the plans and specifications approval date for purposes of the exemption in Section 424(f).

3/16/2015

4. Q: Do DWSRF assistance agreements signed during the time period between September 30, 2014, and December 16, 2014, still have to comply with the AIS requirements?

A: Yes. The Continuing Appropriations Resolution 2015 was signed on September 19, 2014, which extended funding for the DWSRF with the same conditions that were made applicable by the language in the Fiscal Year 2014 appropriations, including the requirement for the use of American Iron and Steel products in projects receiving financial assistance from the DWSRF. Therefore, all assistance agreements starting October 1, 2014, through the enactment of the Consolidated and Further Continuing Appropriations Act 2015 (signed December 16, 2014), must include the AIS requirements. However, if the plans and specifications for any of these projects were approved prior to April 15, 2014 (the date the national waiver was signed), then the project is exempt from the AIS requirements.

The following table summarizes AIS exemptions based on the plans and specifications approval date for DWSRF funded projects.

DWSRF AIS Project Exemption Based on Plans and Specifications Approval Date		
<u>Assistance Agreement Signed:</u>	<u>Exempt from AIS if Plans and Specifications Were Approved Before:</u>	<u>Basis for Exemption:</u>
1/17/2014 through 9/30/2014	4/15/2014	- Consolidated Appropriations Act 2014 - National waiver signed 4/15/2014*
10/1/2014 through 12/15/2014	4/15/2014	- Continuing Appropriations Resolution 2015 (continued CAA 2014 requirements)** - National waiver signed 4/15/2014*
12/16/2014 through 9/30/2015	12/16/2014	Consolidated and Further Continuing Appropriations Act 2015

* To be covered by the national waiver, the plans and specifications had to be submitted to the state prior to 1/17/2014

** Following the first continuing resolution, there were two additional CRs to fill the gap between 12/11/2014 and 12/16/2014

5. Q: Does the AIS requirement apply to refinanced DWSRF projects?

A: Yes, in some cases. If a project began construction, financed from a non-DWSRF source prior to December 16, 2014, but is refinanced through a DWSRF assistance agreement executed on or after December 16, 2014, AIS requirements will apply to all construction that occurs on or after December 16, 2014, through completion of construction, unless engineering plans and

3/16/2015

specifications were approved by the responsible state agency prior to December 16, 2014. For DWSRF projects funded on or after December 16, 2014, there is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to December 16, 2014.

BOTH CWSRF AND DWSRF PROGRAMS

6. **Q: If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, would the product be compliant under the AIS requirements?**

A: Yes. The product would still be considered a compliant product under AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States.

The exemption above only applies to coatings on the *external surface* of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WAIRM

DECISION MEMORANDUM

SUBJECT: De Minimis Waiver of Section 436 of P.L. 113-76, Consolidated Appropriations Act (CAA), 2014

FROM: Nancy K. Stoner
Acting Assistant Administrator

The EPA is hereby granting a nationwide waiver pursuant to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), section 436 under the authority of Section 436(b)(1) (public interest waiver) for de minimis incidental components of eligible water infrastructure projects. This action permits the use of products when they occur in de minimis incidental components of such projects funded by the Act that may otherwise be prohibited under section 436(a). Funds used for such de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel" (AIS) requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use specific domestic iron and steel products that are produced in the United States if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Fiscal Year 2014, unless the agency determines it necessary to waive this requirement based on findings set forth in Section 436(b). The Act states, "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency...finds that- (1) applying subsection (a) would be inconsistent with the public interest" 436(b)(1).

In implementing section 436 of the Act, the EPA must ensure that the section's requirements are applied consistent with congressional intent in adopting this section and in the broader context of the purposes, objectives, and other provisions applicable to projects funded under the SRF. Water infrastructure projects typically contain a relatively small number of high-cost components incorporated into the project. In bid solicitations for a project, these high-cost components are generally described in detail via project specific technical specifications. For these major components, utility owners and their contractors are generally familiar with the conditions of availability, the potential alternatives for each detailed specification, the approximate cost, and the country of manufacture of the available components.

Every water infrastructure project also involves the use of thousands of miscellaneous, generally low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. For many of these incidental components, the country of manufacture and the availability of alternatives is not always readily or reasonably identifiable prior to procurement in the normal course of business; for other incidental components, the country of manufacture may be known but the miscellaneous character in conjunction with the low cost, individually and (in total) as typically procured in bulk, mark them as properly incidental. Examples of incidental components could include small washers, screws, fasteners (i.e., nuts and bolts), miscellaneous wire, corner bead, ancillary tube, etc. Examples of items that are clearly not incidental include significant process fittings (i.e., tees, elbows, flanges, and brackets), distribution system fittings and valves, force main valves, pipes for sewer collection and/or water distribution, treatment and storage tanks, large structural support structures, etc.

The EPA undertook multiple inquiries to identify the approximate scope of de minimis incidental components within water infrastructure projects during the implementation of the American Reinvestment and Recovery Act (ARRA) and its requirements (Buy American provisions, specifically). The inquiries and research conducted in 2009 applies suitably for the case today. In 2009, the EPA consulted informally with many major associations representing equipment manufacturers and suppliers, construction contractors, consulting engineers, and water and wastewater utilities, and performed targeted interviews with several well-established water infrastructure contractors and firms who work in a variety of project sizes, and regional and demographic settings to ask the following questions:

- What percentage of total project costs were consumables or incidental costs?
- What percentage of materials costs were consumables or incidental costs?
- Did these percentages vary by type of project (drinking water vs. wastewater treatment plant vs. pipe)?

The responses were consistent across the variety of settings and project types, and indicated that the percentage of total costs for drinking water or wastewater infrastructure projects represented by these incidental components is generally not in excess of 5 percent of the total cost of the materials used in and incorporated into a project. In drafting this waiver, the EPA has considered the de minimis proportion of project costs generally represented by each individual type of these incidental components within the many types of such components comprising those percentages, the fact that these types of incidental components are obtained by contractors in many different ways from many different sources, and the disproportionate cost and delay that would be imposed on projects if the EPA did not issue this waiver.

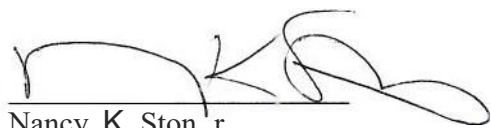
Assistance recipients who wish to use this waiver should in consultation with their contractors determine the items to be covered by this waiver and must retain relevant documentation (i.e., invoices) as to those items in their project files.

If you have any questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kirsten Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

A?R t5 2014

Issued on: _____

Approved by: _____


Nancy K. Stoner
Acting Assistant Administrator

Ohio Water Pollution Control Loan Fund
Use of American Iron and Steel - De Minimis Final Utilization and Certification Form

The Consolidated Appropriations Act of 2014 (P.L. 113-76) Section 436 requires the use of American & Steel in SRF-funded projects. Under the authority of Section 436(b)(1), the EPA has issued a public interest waiver for De Minimis incidental components. The assistance recipient wishing to use this waiver should consult with their contractor(s) to maintain an itemized list of components covered under De Minimis. At the conclusion of the project, this form must be completed and retained in the assistance recipient's project files and a copy provided to DEFA. Please print clearly or type.

Project Name: _____ Loan Agrmt #: _____

NOTE: The De Minimis waiver is only applicable to the cost of materials for the entire project. Do not include other project costs (labor, installation costs, etc.) in the "Total Cost of Materials". The cost of a material must include delivery to the site and any applicable tax. Must have sufficient documentation to support all costs included in this calculation.

Funds used for de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

Total Cost of Materials: 5% Limit: 1% limit:

Manufacturer & Component Description	Part/Model #	Quantity (if applicable)	Cost per Unit (if applicable)	Component's Total Cost	How is Cost Documented?*

Use additional sheets as necessary

Total De Minimis Cost of Components:

If approaching the 5% or 1% limits, contact DEFA immediately

* Documentation must demonstrate confirmation of the components' actual costs (invoice, etc.).

Completed by:

Name: _____

Title: _____

Signature: _____

Date: _____

Prohibition on Telecommunications and Video Surveillance

As required by 2 CFR 200.216, EPA recipients and subrecipients, including borrowers under EPA funded revolving loan fund programs, are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by **Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities)**. Recipients, subrecipients, and borrowers also may not use EPA funds to purchase:

- a. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
 - b. Telecommunications or video surveillance services provided by such entities or using such equipment.
 - c. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.
- Consistent with 2 CFR 200.471, costs incurred for telecommunications and video surveillance services or equipment such as phones, internet, video surveillance, and cloud servers are allowable except for the following circumstances:
- a. Obligating or expending EPA funds for covered telecommunications and video surveillance services or equipment or services as described in 2 CFR 200.216 to:
 - (1) Procure or obtain, extend or renew a contract to procure or obtain;
 - (2) Enter into a contract (or extend or renew a contract) to procure; or
 - (3) Obtain the equipment, services, or systems.

Certain prohibited equipment, systems, or services, including equipment, systems, or services produced or provided by entities identified in section 889, are recorded in the [System for Award Management](#) exclusion list

④ **§ 200.216 Prohibition on certain telecommunications and video surveillance services or equipment.**

- (a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:
 - (1) Procure or obtain;
 - (2) Extend or renew a contract to procure or obtain; or
 - (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in [Public Law 115–232](#), section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
 - (i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
 - (ii) Telecommunications or video surveillance services provided by such entities or using such equipment.
 - (iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.
 - (b) In implementing the prohibition under [Public Law 115–232](#), section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.
 - (c) See [Public Law 115–232](#), section 889 for additional information.
 - (d) See also [§ 200.471](#).
-

Resources:

[2 CRF 200.216](#)

FAQ's: [Sec. 889 of 2019 NDAA FAQ 20201124.pdf \(performance.gov\)](#)

[Public Law 115-232, Section 889](#)

[§ 200.471](#)

SECTION 9
PREVAILING WAGE RATES

Davis-Bacon Wage Rate Requirements

(required contract provision)

Background and Applicability

On October 30, 2009, P.L. 111-88, "Making appropriations for the Department of the Interior, environment, and related agencies for the fiscal year ending September 30, 2010, and for other purposes," was enacted. This law provides appropriations for both the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) for Fiscal Year 2010, while adding new requirements to these already existing programs. One new requirement requires the application of Davis-Bacon Act requirements.

Application of the Davis-Bacon Act requirements extend not only to assistance agreements funded with Fiscal Year 2010 appropriations, but to all assistance agreements executed on or after October 30, 2009, whether the source of the funding is prior year's appropriations, state match, bond proceeds, interest earnings, principal repayments, or any other source of funding so long as the project is financed by an SRF assistance agreement. If a project began construction prior to October 30, 2009 but is financed or refinanced through an assistance agreement executed on or after October 30, 2009, Davis-Bacon Act requirements will apply to all construction that occurs on or after October 30, 2009, through completion of construction.

Ohio EPA Responsibilities

With respect to the Water Pollution Control Loan Fund (WPCLF) and Water Supply Revolving Loan Account (WSRLA) revolving funds, EPA provides capitalization grants to each State which in turn provides funding assistance to eligible recipients within the State. Typically, the assistance recipients are municipal or other local governmental entities that manage the funds. Occasionally, the assistance recipients may be a private for profit or not for profit entity. Although EPA and the State are responsible for ensuring assistance recipients incorporate the wage rate requirements set forth herein as part of contracts for WPCLF and WSRLA funding, the assistance recipient has the primary responsibility to maintain payroll records and for compliance with Davis-Bacon Act requirements as described below.

Municipal Or Other Local Governmental Entities Recipient's Responsibilities

The following is intended to help assistance recipients understand and meet their obligations related to Davis-Bacon (DB). Each assistance recipients should, however, review the contract/subcontract requirements that are set forth later in this document for a more full understanding of DB obligations.

Prior to advertising for bids:

- > Obtain the wage determination for the locality in which a covered activity subject to DB will take place from the Department of Labor (DOL) at www.wdol.gov.
- > Incorporate these wage determinations into the request for bids.
- > Include the required contract provisions (see below) into the contract documents.
- > Require prime contracts to include provisions that subcontractors follow the wage determination incorporated into the prime contract.

During the advertisement period:

- > Monitor www.wdol.gov on a weekly basis to ensure that the wage determination contained in the request for bids remains current.
- > If DOL modifies the DB wage determination more than 10 days prior to the bid opening, issue an addendum reflecting the modification.
- > If DOL modifies or supersedes the DB wage determination less than 10 days prior to bid opening and you cannot issue an addendum for the change, you must request a finding from Ohio EPA that there is not reasonable time to notify interested contractors of the modification of the wage determination. The Ohio EPA will give you a report of its findings.

After opening bids:

- > If the contract(s) aren't awarded within 90 days of the bid opening you must monitor www.wdol.gov on a weekly basis to ensure that wage determinations used in the bids remain current.
- > If the contract(s) aren't awarded within 90 days of the bid opening, any modifications or supersedes that DOL makes to the wage determination must be incorporated into the contract unless (1) you request an extension from Ohio EPA AND (2) Ohio EPA obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv).

After contracts are signed and during construction:

- > Review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.
- > DOL may issue a revised wage determination applicable to one or all of your contracts after the award of the contract or execution of the change order which incorporated DB requirements into the contract if DOL determines that you have failed to incorporate a wage determination or have used a wage determination that clearly does not apply to the contract. If this occurs, you shall either terminate the contract or change order and rebid the contract OR incorporate DOL's wage determination retroactive to the beginning of the contract by change order. The contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.
- > Periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. You must use Standard Form 1445 or equivalent documentation to memorialize the interviews.
- > Establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, you must:
 - conduct all interviews in confidence.
 - conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract.
 - conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB.
 - immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements.
- > Periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. You must:
 - establish and follow a spot check schedule based on your assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract.
 - spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract at a

minimum.

- conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB.
- during the examinations, verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

> Periodically review contractors' and subcontractors' use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the DOL or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews.

> Immediately report potential violations of the DB prevailing wage requirements to Andrew Lausted at EPA Region V at 312-886-0189 and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/esa/contacts/whd/america2.htm>.

If contracts have already been signed and DB requirements need to be incorporated:

> If contracts have already been signed prior to WPCLF/WSRLA funding being provided, you must issue a change order, task order, work assignment or similar legally binding instrument and incorporate the appropriate DOL wage determination from www.wdol.gov as well as the required contract provisions into the contract(s).

> Initiate the contractor and subcontractor review and wage interview requirements as described above and provided in the **Contract And Subcontract Provisions**.

**Private For Profit Or Not For Profit (Non-Governmental) Entities
Recipient's Responsibilities**

The requirements, responsibilities and contract provisions for Private For Profit or Not For Profit Entities (Non-Governmental Entities) is exactly the same as for Municipal Or Other Local Governmental Entities EXCEPT for the following:

Prior to advertising for bids:

> Obtain the proposed wage determinations for specific localities from www.wdol.gov.

> Submit the wage determination to Ohio EPA for approval prior to inserting the wage determination into the solicitation unless subsequently directed otherwise by Ohio EPA.

Contract And Subcontract Provisions For Contracts In Excess Of \$2,000

The following language must be included in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part with WPCLF or WSRLA funds and which is subject to the labor standards provisions of any of the acts listed in §5.1:

NOTE: Modify the first sentence to include the name of the WPCLF/WSRLA funding recipient prior to including these provisions in the contract documents.

Wage Rate Requirements

As used in these provisions "subrecipient" means _____ (fill in WPCLF/WSRLA funding recipient name here).

(a) The following applies to any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1.

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.wdol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the questions, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account asset for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions

or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5(a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5(a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional

Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees --

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S.

Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Contract Provision For Contracts In Excess Of \$100,000 And Subject To The Overtime Provisions Of The Contract Work Hours And Safety Standards Act

The following language must be included in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These provisions are to be included in addition to the provisions for contracts in excess of \$2,000. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(b) Contract Work Hours and Safety Standards Act. The following applies to any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. As used in these paragraphs, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

Contract Provision For Contracts In Excess Of \$100,000 Subject ONLY To The Contract Work Hours And Safety Standards Act

In addition to the provisions for contracts in excess of \$2,000, for any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, you must insert clauses requiring:

(c) The following applies to any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1.

The contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid.

The records shall be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Ohio EPA, EPA and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

PREVAILING WAGE ORIENTATION MEETING

After award of contract the prime contractor and all approved subcontractors shall participate in a prevailing wage orientation meeting.

ONLINE FILLABLE WH-347 FORM

The On-line .pdf Fillable Form for Davis-Bacon and Related Acts Weekly Certified Payroll HW-347 is located at <https://www.dol.gov/agencies/whd/forms/wh347>

Davis-Bacon and Related Acts Weekly Certified Payroll Form
(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)



Unless otherwise noted, the information requested is specific to the named project below.
Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

Rev. January 2025
OMB No.: 1235-0008
Expires: 01/31/2028

☐ SUBMISSION OF FINAL DBRA CERTIFIED PAYROLL FORM

☐ PRIME CONTRACTOR

☐ SUBCONTRACTOR

PROJECT NAME		PROJECT NO. or CONTRACT NO.		CERTIFIED PAYROLL NO.		PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME										
PROJECT LOCATION		WAGE DETERMINATION NO.		WEEK ENDING DATE		PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS ADDRESS										
WORKER ENTRY NO.	WORKER LAST NAME	WORKER FIRST NAME	WORKER MIDDLE INITIAL	WORKER IDENTIFYING NO.	(1) JOURNEYWORKER (RA) REGISTERED APPRENTICE	(2) LABOR CLASSIFICATION	(3) ST = STRAIGHT TIME OT = OVERTIME	(4) (TOP) DAYS OF WORK WEEK (BOTTOM) DATES S M Tu W Th F S HOURS WORKED EACH DAY	(5) TOTAL HOURS WORKED FOR WEEK	(6A) PAID FOR ST AND OT	(6B) TOTAL FRINGE BENEFIT CREDIT	(6C) PAYMENT IN LIEU OF FRINGE BENEFITS	(7A) GROSS AMT EARNED	(7B) GROSS AMT EARNED FOR ALL WORK	(8) DEDUCTIONS FOR ALL WORK TAX WITH- HOLDINGS FICA OTHER (MUST SPECIFY, SEE INSTRUCTIONS) TOTAL DEDUCTIONS	(9) NET PAY TO WORKER FOR ALL WORK
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							
							ST OT		0.00							

While use of Form WH-347 itself is optional, covered contractors and subcontractors performing work on Federal or federally assisted construction contracts are required by the DBRA regulations and the contract clauses to submit payroll information on a weekly basis. The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federal or federally financed construction contracts to, on a weekly basis, "furnish a statement on the wages paid each employee during the prior week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors and subcontractors to submit weekly certified payrolls to the appropriate Federal agency if the agency is a party to the contract (or, if the agency is not such a party, to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Federal agency). Each certified payroll must be accompanied by a signed "Statement of Compliance" (e.g., page 2 of the WH-347 or another document with identical wording) indicating that the certified payrolls are accurate and complete, and that each laborer or mechanic has been paid not less than the required Davis-Bacon prevailing wage rate(s) (including any fringe benefits) for the work performed. DOL and contracting agencies receiving this information review the information to determine whether workers have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room 53502, 200 Constitution Avenue, N.W., Washington, D.C. 20210 (over)

PROJECT NAME	PROJECT NO. or CONTRACT NO.	PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME							
PROJECT LOCATION		WEEK ENDING DATE	CERTIFYING OFFICIAL'S NAME AND TITLE							
I paid or supervised the payment of the laborers or mechanics working on the above project during the stated time period. I certify the following: ☐ The payroll information submitted with this statement is correct and complete for the above project during the above period, and the wage and fringe benefit rates paid to the workers, including credit taken for the reasonably anticipated costs of a bona fide fringe benefit plan, fund or program, are not less than the applicable wage and fringe benefits rates for the classification(s) of work actually performed, as specified in the wage determination(s) incorporated into the contract. ☐ All regular payrolls and all other basic records that the contractor is required to maintain for this payroll period are complete and accurate and will be made available upon request from the agency or the Department of Labor. ☐ The classifications reported for each laborer or mechanic are the classification(s) of work that each worker actually performed. ☐ Any workers paid as apprentices during the above period are duly registered in a bona fide apprenticeship program registered with the Office of Apprenticeship, Employment and Training Administration, United States Department of Labor ("OA"), or a State Apprenticeship Agency ("SAA") recognized by Department of Labor. I have verified the registered apprenticeship program information provided below as accurate and applicable to any apprentices identified on page 1 of this form.										
APPRENTICESHIP PROGRAM NAME		NAME OF LABOR CLASSIFICATION								
		☐ OA ☐ SAA								
		☐ OA ☐ SAA								
		☐ OA ☐ SAA								
Fringe benefits have been paid in cash and/or to bona fide fringe benefit plans, funds, or programs. Where the contractor is claiming an hourly credit for their contributions to or reasonably anticipated costs of a bona fide fringe benefit plan, fund, or program, provide plan information and the hourly credit claimed for each worker listed on the previous page of this form.										
DB.12										
HOURLY CREDIT FOR FRINGE BENEFITS										
If an amount is listed in (6B) on the first page of this certified payroll form, enter the hourly credit claimed under each plan name, type and number for each worker and check whether the plan is funded or unfunded.										
NAME OF WORKER	FB NAME	FB TYPE	PLAN NO.	FB NAME	FB TYPE	PLAN NO.	FB NAME	FB TYPE	PLAN NO.	TOTAL HOURLY CREDIT
	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded	☐ Funded ☐ Unfunded
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	Hourly Credit	\$ 0.00
All workers on the project have been paid the full weekly wages earned, and no rebates or deductions have been or will be made either directly or indirectly, other than permissible deductions as defined in 29 CFR part 3.										
ADDITIONAL REMARKS										
SIGNATURE OF CERTIFYING OFFICIAL				DATE		TELEPHONE NUMBER		EMAIL ADDRESS		
						(---) ---				
THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION (SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE), AS WELL AS DEBARMENT FROM FUTURE FEDERAL AND FEDERALLY-ASSISTED CONTRACTS. INFORMATION REPORTED IN CERTIFIED PAYROLLS MAY BE SUBJECT TO DISCLOSURE IN RESPONSE TO A FREEDOM OF INFORMATION ACT REQUEST.										

Wage and Hour Division

Instructions For Completing Davis-Bacon and Related Acts Weekly Certified Payroll Form, WH-347

- [WH-347 \(PDF\)](#)
OMB Control No. 1235-0008, Expires 01/31/2028.
- [WH-347 Form Annotated Guide \(PDF\)](#)
- [Online Fillable WH-347 Form](#)

General: Form WH-347 is available for the convenience of contractors and subcontractors to submit certified weekly payrolls in connection with their Federal or federally assisted construction contracts and subcontracts. Properly completed, this form will satisfy the requirements of the regulations in parts 3 and 5 of Title 29 of the Code of Federal Regulations (CFR) as to certified payrolls submitted in connection with contracts subject to the Davis-Bacon and Related Acts (DBRA).

While use of Form WH-347 itself is optional, covered contractors and subcontractors performing work on Federal or federally assisted construction contracts are required by the DBRA regulations and the contract clauses to submit payroll information on a weekly basis. The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federal or federally financed construction contracts to, on a weekly basis, “furnish a statement on the wages paid each employee during the prior week.” U.S. Department of Labor (DOL) Regulations at 29 CFR 5.5(a)(3)(ii) require contractors and subcontractors to submit weekly certified payrolls to the appropriate Federal agency if the agency is a party to the contract (or, if the Federal agency is not party to the contract, to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Federal agency that provided the Federal assistance). Each certified payroll must be accompanied by a signed “Statement of Compliance” (e.g., page 2 of the WH-347 or another document with *identical* wording) indicating that the certified payrolls are accurate and complete, and that each laborer or mechanic has been paid not less than the required Davis-Bacon prevailing wage rate(s) (including any fringe benefits) for the work performed. DOL and contracting agencies receiving this information review the information to help determine whether workers have received legally required wages and fringe benefits.

Under the DBRA, contractors and subcontractors are required to pay not less than the prevailing wage, including fringe benefits, as predetermined by DOL. The contractor’s obligation to pay fringe benefits may be met through the contractor’s contributions to or reasonably anticipated costs of bona fide benefit plans, funds, or programs, or by paying workers cash in lieu of fringe benefits.

Form WH-347 provides fields for contractors and subcontractors to document all wages paid to each worker, whether paid entirely as cash wages or by a combination of cash wages and employer-provided bona fide fringe benefits, and provides for the contractor or subcontractor’s certification in the Statement of Compliance (as shown on page 2 of Form WH-347) that the data and payroll information on the form are accurate and complete. The Statement of Compliance also provides for the representation that the contractor or subcontractor is paying its workers, including registered apprentices, at least the required wage rates, satisfying its fringe benefits obligations, and maintaining required payroll records.

Detailed instructions for completing the first page of Form WH-347 follow:

“Check Box” for Submission of Final DBRA Certified Payroll Form: Mark the box to indicate that this submission is for the final week of work on the project for the contractor or subcontractor.

“Check Box” for Prime Contractor or Subcontractor: Mark the appropriate box to indicate whether it is the prime contractor or a subcontractor on the project for which certified payroll is being reported.

Project Name: Enter the name of the project on which you are reporting.

Project No. or Contract No.: Enter the project number or the prime contract number assigned by the relevant contracting agency (if available).

Certified Payroll No.: Beginning with the number “1”, each weekly certified payroll that a contractor or subcontractor submits for a project should be given a payroll number. Enter the appropriate payroll number.

Prime Contractor's/Subcontractor's Business Name: Enter the business' legal name.

Project Location: Enter the complete address of the project, or, if there is no specific address, a description of the project location, including, at a minimum, the county or counties and state in which the project is located.

Wage Determination No.: Enter the wage determination number(s) and revision number(s) included in the covered contract and relevant to the submitted certified payroll form (e.g., if there are multiple wage determinations applicable to the project, please list all wage determinations that applied to the work performed by the workers in this pay period).

Week Ending Date: Enter the workweek ending date for this pay period.

Prime Contractor's/Subcontractor's Business Address: Enter the company's full business address.

Column 1A – Worker Entry No.: Beginning with the number “1”, enter each worker's entry number (e.g., entry in row 2 may be 2, entry in row 3 may be 3, etc. If reporting more than 8 entries, row 1 on page 2 may be entry 9 and row 1 on page 3 may be entry 17, etc.). If a worker works in more than one labor classification during the course of the week, the contractor should show the number of hours the worker worked in each classification using separate rows. In such circumstances, the same worker entry number should be used on each row associated with the worker.

Column 1B – Worker Last Name: Self-explanatory.

Column 1C – Worker First Name: Self-explanatory.

Column 1D – Worker Middle Initial: Self-explanatory.

Column 1E – Worker Identifying No.: Enter each worker's individual identifying number (e.g., last four digits of the worker's social security number or any number specific to the individual worker) on each weekly certified payroll submitted. **Note:** *workers' full Social Security numbers must **not** be included.*

Column 2 – Journeyworker / Registered Apprentice: Enter “J” if the worker is a journeyworker or “RA” if the worker is a registered apprentice in an apprenticeship program approved by DOL's Office of Apprenticeship (OA) or a State Apprenticeship Agency (SAA). For registered apprentices, also list their level of progression within the approved program.

Column 3 – Labor Classification: List the labor classification for the work actually performed by each worker. Labor classifications are found in the applicable Davis-Bacon wage determination(s) that are included in the contract for this project. If the wage determination(s) does not include a labor classification for work that a worker has performed on this contract, contact the Contracting Officer or Agency representative immediately.

If a worker performed work in more than one labor classification during the week, the worker must be paid at least the rate specified for the appropriate labor classification for the time actually worked in that labor classification. In such circumstances, an accurate breakdown of hours worked in each labor classification must be shown on the submitted payroll by using a separate row for each labor classification in which the worker performed work. If the contractor did not maintain an accurate breakdown of hours worked by a worker in each labor classification, the worker must be paid for all hours worked using the highest applicable prevailing wage rate (basic hourly rate and fringe benefits).

Column 4 – Hours Worked Each Day: In column 4 in the table above row 1, please enter the first letter for each day of the contractor's workweek in each box on the top row and its corresponding date in each box on the second row below it. For example, if a contractor's workweek starts on Tuesday and ends on Monday, enter “T” for Tuesday in the first box of the first row and continue with the appropriate letter identifying the day of the week for each box ending with “M” on the last box of the first row. In the second row, enter the corresponding date for each day of the week. Please see example below:

T	W	T	F	S	S	M
6/16	6/17	6/18	6/19	6/20	6/21	6/22

For worker-specific entries, please enter hours worked on this project as straight time (“ST”) and overtime (“OT”) in the applicable boxes. On all contracts subject to the Contract Work Hours and Safety Standards Act (CWHSSA), enter hours worked on this project in excess of 40 hours total in the week as overtime (“OT”) (including hours worked on and off the site of the work of the covered contract). **Note:** *For more information about compliance with overtime requirements on Federal and federally assisted contracts, please visit [Overtime Pay on Government Contracts](#).*

Column 5 – Total Hours Worked for the Week: Enter the total number of the hours worked entered in column four.

Column 6A – Hourly Wage Rate Paid for ST and OT: For each worker, list the actual hourly rate paid for straight time (top row) and overtime (bottom row) worked for work in the classification indicated in column 3. If the worker was paid at a higher rate than the wage rate required on the wage determination, indicate the wage rate the worker was actually paid. **Note:** *do not include cash payments in lieu of fringe benefits in this column.*

Column 6B – Total Fringe Benefit Credit: Enter the total of the contractor's or subcontractor's contributions to or reasonably anticipated costs of bona fide fringe benefit plans, funds, or programs for which the contractor or subcontractor is taking a credit toward satisfying Davis-Bacon prevailing fringe benefit rates as listed on page 2 of Form WH-347 under "Hourly Credit for Fringe Benefits". This amount should equal the worker's total hours worked in this period multiplied by the hourly credit for fringe benefits as listed under the Total Hourly Credit column on page 2 of Form WH-347 under "Hourly Credit for Fringe Benefits".

Column 6C – Payment in Lieu of Fringe Benefits: Enter the total amount in cash provided in lieu of fringe benefits to the worker during the workweek. This amount should equal the worker's total hours worked in this period multiplied by the hourly rate provided to the worker as cash in lieu of fringe benefits.

Column 7A – Gross Amount Earned: Enter the worker's gross amount earned for the workweek for hours worked on this Federal or federally assisted project.

Column 7B – Gross Amount Earned for all Work: If part of a worker's weekly wage was earned on projects or work other than the project described on this payroll, including non-DBRA covered projects, enter in column 7B the total gross amount earned during the week for all work performed during the week.

Column 8 – Deductions for all Work: Enter all deductions made from worker's total gross amount earned for all work (Column 7B). Columns are provided for entering deductions made for tax withholdings, FICA, and "Other" deductions. If the amount under "Other" deductions is specific to one deduction, please describe the deduction under "Additional Remarks" on page 2 of this certified payroll form. If the amount under the "Other" deductions made from the worker's pay is a result of more than one deduction, submit an addendum that itemizes each deduction and includes a description and amount for each deduction listed on that document. Enter the total amount for all deductions actually made under the "Total Deductions" column (include the amounts listed under the Tax Withholdings, FICA and Other columns). All deductions must be in accordance with the provisions of the Copeland Act Regulations, 29 CFR part 3. If a worker worked on other jobs in addition to this project, do not pro-rate the deductions; instead, show actual deductions from the worker's weekly gross wage for all projects. **Note:** *Except for deductions listed in 29 CFR 3.5, all deductions must have prior approval from the Department of Labor.*

Column 9 – Net Payment to Worker for All Work: Enter the actual dollar amount paid to the worker for all hours worked across all projects (including non-DBRA covered projects) during the week.

Detailed instructions for completing the second page of Form WH-347 follow:

Project Name: Enter the name of the project on which you are reporting.

Project No. Or Contract No.: Enter the project or prime contract number associated with your contract assigned by the relevant contracting agency (if available).

Payroll No.: Beginning with the number "1", each weekly certified payroll that a contractor or subcontractor submits for a project should be given a payroll number. Enter the appropriate payroll number.

Prime Contractor's/Subcontractor's Business Name: Enter the business' legal name.

Project Location: Enter the complete address of the project, or, if there is no specific address, a description of the project location, including, at a minimum, the county or counties and state in which the project is located.

Week Ending Date: Enter the workweek ending date for this pay period.

Certifying Official's Name and Title: Print the name and official title of the contractor or subcontractor, or their agent who paid or supervised the payment of the workers under the contract during the weekly time period covered by the form.

Statement of Compliance: While the "Statement of Compliance" need not be notarized, the statement (on page 2 of this certified payroll form) is subject to the penalties provided by 18 U.S.C. § 1001, namely, a fine, possible imprisonment of not more than 5 years, or both. Accordingly, the party signing this statement should have knowledge of the facts represented as true.

If applicable, please "check" each of the 6 boxes certifying the accompanying statement as accurate. Boxes 1, 2, 3 and 6 (i.e., the first three boxes and the last box) always **must** be checked to certify that the contractor or subcontractor completing the form is in compliance with the DBRA.

If any worker is being paid as an apprentice during the period, box 4 **must** be checked and each program name in which the contractor has registered apprentices working on the project during this payroll period must be listed, with the appropriate box checked to indicate whether the apprenticeship program is registered with DOL's Office of Apprenticeship (OA) or a State Apprenticeship Agency (SAA), and the name of the labor classification entered. If more than three entries are required, please submit an addendum providing the requested information with the submission of the certified payroll. If box 4 is not applicable, do not check the box and enter "Not Applicable" or "N/A" in the entry subsection, under Apprenticeship Program Name.

If the contractor or subcontractor is claiming an hourly credit for their contributions to or reasonably anticipated costs of bona fide fringe benefit plans, funds, or programs, box 5 must be checked and the subsections titled "Hourly Credit for Fringe Benefits" must be completed. In the first column, list each worker entry number (entered in column 1A on the first page) and name of worker for whom the contractor or subcontractor claimed an hourly fringe benefit credit (this should mirror the worker names and order found on Page 1 of the certified payroll form). In the following columns, list each fringe benefit plan name in the top row, fringe benefit plan type in the second row, fringe benefit plan number in the third row, mark whether the fringe benefit plan is funded or unfunded in the fourth row, and state the hourly amount of credit claimed for each worker under each applicable plan in the rows below. In the last column, list the total hourly cost of fringe benefit provided for each worker. Where the contractor or subcontractor is claiming a credit for the reasonably anticipated costs of fringe benefits provided directly by the contractor (commonly referred to as an "unfunded plan"), the contractor or subcontractor must have prior approval from the Department of Labor prior to claiming such credit as required in 29 CFR 5.28. If more than six bona fide fringe benefits are provided to the workers for which the contractor is claiming a credit, submit an addendum for each providing the information requested in this section.

Note: If the contractor or subcontractor is meeting its fringe benefit obligations partially through contributions to or reasonably anticipated costs of a bona fide fringe benefit plan and partially through the payment of cash in lieu of fringe benefits, the contractor or subcontractor should enter the respective amounts in this section and in column 6C (Cash Payment in Lieu of Fringe Benefits) on page 1. If the contractor or subcontractor is meeting its fringe benefits obligations by simply paying the cash equivalent to each worker, check the box but do not complete the subsection, because those payments will be reported under column 6C (Cash Payment in Lieu of Fringe Benefits) on page 1.

Additional Remarks: Optional space for additional information on deductions, hourly cost of fringe benefits, or explanations. If more space is needed, please continue remarks on a separate page. If the optional space or separate pages are used, please include all contractor and project information required by the form.

Signature of Certifying Official, Date, Telephone Number, and Email Address: The Statement of Compliance must be signed by the contractor or subcontractor, or their agent who paid or supervised the payment of the workers under the contract during the weekly time period covered by the form. Enter the phone number and email address of the individual who is signing the statement and the date signed. Legally valid electronic signatures are acceptable. A legally valid electronic signature includes any electronic process that indicates acceptance of the certified payroll record and includes an electronic method of verifying the signer's identity.

Note: Photocopies or scanned copies of signatures do not satisfy this requirement.

Public Burden Statement: We estimate that it will take an average of 55 minutes to complete this collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

Note: In order to view, fill out, and print PDF forms, you need Adobe® Acrobat® Reader® version 5 or later, which you may download for free at www.adobe.com/products/acrobat/readstep2.html.

Topics	Worker Rights	For Employers	Resources	Interpretive Guidance	State Laws



FEDERAL GOVERNMENT	LABOR DEPARTMENT	WHD PORTALS

White House

About DOL

YouthRules!

Disaster Recovery Assistance Guidance Search

Wage Determinations

DisasterAssistance.gov

Español
DB.16

Accessibility Statement

Wage and Hour Division

An agency within the U.S.
Department of Labor

200 Constitution Ave NW
Washington, DC 20210
[1-866-4-US-WAGE](tel:1-866-4-US-WAGE)
[1-866-487-9243](tel:1-866-487-9243)
www.dol.gov

USA.gov

[No Fear Act Data](#)

[U.S. Office of Special Counsel](#)

[Office of Inspector General](#)

[A to Z Index](#)

Connect With DOL



[Important Website Notices](#) | [Privacy & Security Statement](#)

The completion of the WH-347 Davis Bacon and Related Acts Weekly Certified Payroll Form is optional; The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired.

DB.18

CONTRACTOR FRINGE BENEFIT STATEMENT

Contract # /Project Name:	Contract Location:	Today's Date:
Contractor / Subcontractor Name:		Business Address:

In order that the proper Fringe Benefit rates can be verified when checking payrolls on the above contract, the hourly rates for fringe benefits, subsistence and/or travel allowance payment made for employees by the employer on the various classes of work are tabulated below. Please Include Apprentice Rates.

Classification:		Effective Date:	Subsistence or Travel Pay: \$
EMPLOYER PAID FRINGE BENEFITS	Health & Welfare \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Pension \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Vacation/Holiday \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Training \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Other \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	

Classification:		Effective Date:	Subsistence or Travel Pay: \$
EMPLOYER PAID FRINGE BENEFITS	Health & Welfare \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Pension \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Vacation/Holiday \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Training \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	
	Other \$ _____ hr	Paid To: Name of Plan/Fund/Program: Address:	

Supplemental statements must be submitted during the progress of the work should there be an increase or change in rates. Use additional sheets as necessary. (Attach a copy of your most recent premium transmittal (including copy of check submitted) into each of the above plans/funds/programs or a letter from the above plans/funds/programs reflecting current payment status).

I certify under penalty of perjury that fringe benefits are paid to the approved plans, funds or programs as listed above.

Name and Title	Signature and Date (Wet Signature Required)

Prevailing Wage Notification to Employee

4115.05: ...the contractor or subcontractor shall furnish each employee **NOT covered by a collective bargaining agreement** written notification of the job classification to which the employee is assigned, the prevailing wage determined to be applicable to that classification, separated into the hourly rate of pay and the fringe payments, and the identity of the prevailing wage coordinator appointed by the public authority. The contractor or subcontractor shall furnish the same notification to each affected employee every time the job classification of the employee is changed.

Project Name:	Project Number:
Contractor:	
Project Location:	

Prevailing Wage Coordinator	Employee
Public Authority:	Name:
Name of PWC:	Street:
Street:	City:
City:	State/Zip:
State:	Phone Number:
Zip:	Email:
Phone:	Last 4 Digits of SS#:

You will be performing work on this project that falls under these classifications. You will be paid the appropriate rate for the type of work you are performing.

Classification:	Prevailing Wage Rate Total Package:	Minus your fringe benefits*:	Your hourly base rate and overtime:
			/
			/
			/
			/
			/
			/

Hourly fringe benefits paid on your behalf by this company (Yearly amount the **company pays** divided by 2080):

Fringe	Amount	Fringe	Amount
Health Insurance		Vacation	
Life Pension		Holiday	
Pension		Sick Pay	
Other (Specify):		Training	
Other (Specify):		Total Hourly Fringes *	

Contractor's Signature:	Date:
Employee's Signature:	Date:

Certified payroll Report for Non-Performing Week

Owner:

Project:

Prime Contractor:

Subcontractor (if subcontractor report):

For week beginning on:

For week ending on:

Payroll Number:

Project Number:

CERTIFICATION FOR NON-PERFORMING WEEK

I, _____ (*Name of PWC*), the undersigned, am the Prevailing Wage Coordinator with the authority to act for and on behalf of _____ (*Company Name*), do hereby certify under penalty of perjury that no work was performed for the week referenced above.

Signature

Name, Prevailing Wage Coordinator

Wage Determinations are issued for four types of construction categories:

Heavy Construction includes projects that cannot be classified as Building, Residential, or Highway. Heavy construction is often further distinguished on the basis of the characteristic of particular projects, such as dredging, water and sewer lines, dams, major bridges, and flood control projects.

Highway Construction includes the construction, alteration, or repair of roads, streets, highways, runways, parking areas and most other paving work not incidental to building, residential, or heavy construction.

Heavy and Highway are grouped together as one State Wide Determination in Ohio.

Building Construction includes the construction, alteration, or repair of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies and the associated installation of utilities and equipment, as well as incidental grading and paving.

Residential Construction includes the construction, alteration, or repair of single family houses, townhouses, and apartment buildings of no more than four stories in height and all incidental work, such as site work, parking areas, utilities, streets, and sidewalks.

***This project includes Wage Determinations for both
Building and Heavy/Highway.***

"General Decision Number: OH20260030 05/18/2026

State: Ohio

Construction Types: Building

Counties: Ohio Counties of
Adams

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ASBE0080-001 02/24/2025		
	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 38.05	30.87

BROH0039-003 06/01/2024		
	Rates	Fringes
BRICKLAYER.....	\$ 36.60	22.85

BROH0046-004 09/01/2023		
	Rates	Fringes
TILE SETTER.....	\$ 32.41	16.36
TILE FINISHER.....	\$ 27.87	16.31

ELEC0575-004 05/29/2023		
	Rates	Fringes
ELECTRICIAN (EXCLUDES LOW VOLTAGE WIRING AND INSTALLATION OF ALARMS).....	\$ 37.00	22.26

ELEC0972-004 06/01/2024		
	Rates	Fringes
ELECTRICIAN (ALARM INSTALLATION ONLY).....	\$ 40.00	33.32

ELEC0972-005 06/01/2024		
	Rates	Fringes
ELECTRICIAN (LOW VOLTAGE WIRING ONLY).....	\$ 40.00	33.32

ELEV0011-002 01/01/2025		
	Rates	Fringes
ELEVATOR MECHANIC PAID HOLIDAYS: A. NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, VETERN'S DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING, AND CHRISTMAS DAY. B. EMPLOYER CONTRIBUTES 8% OF REGULAR HOURLY RATE TO VACATION PAY CREDIT FOR EMPLOYEE WHO HAS WORKED IN BUSINESS MORE THAN 5 YEARS; 6% FOR LESS THAN 5 YEARS' SERVICE.....	\$ 57.41	38.44

ENGI0018-022 05/01/2024		
	Rates	Fringes
POWER EQUIPMENT OPERATOR: FORKLIFT.....	\$ 42.98	16.41
POWER EQUIPMENT OPERATOR: CRANE.....	\$ 44.14	16.41
POWER EQUIPMENT OPERATOR (BOBCAT/SKID STEER/SKID LOADER; BULLDOZER).....	\$ 44.02	16.41

IRON0550-012 05/01/2025		
	Rates	Fringes
IRONWORKER: ORNAMENTAL.....	\$ 36.00	23.57

IRON0769-001 06/01/2025		

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 39.70	29.59

LABO0083-002 06/01/2024		
	Rates	Fringes
LABORER (MASON TENDER - BRICK & CEMENT/CONCRETE)....	\$ 40.97	14.10

PAIN0093-003 12/01/2024		
	Rates	Fringes
PAINTER: BRUSH AND ROLLER.....	\$ 30.28	24.46

PAIN1195-001 12/01/2024		
	Rates	Fringes
GLAZIER.....	\$ 32.89	14.33

PLAS0132-011 06/01/2025		
	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER.....	\$ 35.12	17.40

PLUM0577-001 06/01/2025		
	Rates	Fringes
PIPEFITTER (EXCLUDES HVAC PIPE INSTALLATION).....	\$ 38.89	28.56

PLUM0577-003 06/01/2025		
	Rates	Fringes
PLUMBER (INCLUDES HVAC PIPE INSTALLATION).....	\$ 38.89	28.56

SFOH0669-009 04/01/2025		
	Rates	Fringes
SPRINKLER FITTER (FIRE SPRINKLERS).....	\$ 48.28	28.08

SHEE0024-010 06/01/2022		
	Rates	Fringes
SHEET METAL WORKER (HVAC DUCT AND UNIT INSTALLATION ONLY).....	\$ 33.53	26.36

SHEE0033-008 06/01/2022		
	Rates	Fringes
SHEET METAL WORKER (EXCLUDES HVAC DUCT AND UNIT INSTALLATION).....	\$ 31.73	27.44

SUOH2012-032 08/29/2014		
	Rates	Fringes
TRUCK DRIVER: DUMP (ALL TYPES).....	\$ 19.33	6.55
OPERATOR: PAVER (ASPHALT, AGGREGATE, AND CONCRETE).....	\$ 23.91	10.42
OPERATOR: LOADER.....	\$ 22.69	8.01
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE.....	\$ 29.18	10.69
LABORER: PIPELAYER.....	\$ 18.37	4.79
LABORER: COMMON OR GENERAL.....	\$ 25.82	8.65
DRYWALL HANGER AND METAL STUD INSTALLER.....	\$ 22.27	14.40
DRYWALL FINISHER/TAPER.....	\$ 20.66	4.91
CARPENTER.....	\$ 25.80	12.54

UAVGOH0001 01/01/2019		
	Rates	Fringes
IRONWORKER: REINFORCING.....	\$ 29.44	22.68

UAVGOH0002 01/01/2019		
	Rates	Fringes
ROOFER.....	\$ 30.19	15.73

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the

Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ♦SU♦, ♦UAVG♦, ♦SA♦, or ♦SC♦ denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The **◆SU◆** identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

◆SU◆ wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The **◆SA◆** identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the **◆SA◆** identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an

interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:
Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

"General Decision Number: OH20260001 06/25/2026

State: Ohio

Construction Types: Heavy and Highway

Counties: Ohio Counties of
Adams, Allen, Ashland, Ashtabula,
Athens, Auglaize, Belmont, Brown,
Butler, Carroll, Champaign, Clark,
Clermont, Clinton, Columbiana,
Coshocton, Crawford, Cuyahoga, Darke,
Defiance, Delaware, Erie, Fairfield,
Fayette, Franklin, Fulton, Gallia,
Geauga, Greene, Guernsey, Hamilton,
Hancock, Hardin, Harrison, Henry,
Highland, Hocking, Holmes, Huron,
Jackson, Jefferson, Knox, Lake,
Lawrence, Licking, Logan, Lorain, Lucas,
Madison, Mahoning, Marion, Medina,
Meigs, Mercer, Miami, Monroe,
Montgomery, Morgan, Morrow, Muskingum,
Noble, Ottawa, Paulding, Perry,
Pickaway, Pike, Portage, Preble, Putnam,
Richland, Ross, Sandusky, Scioto,
Seneca, Shelby, Stark, Summit, Trumbull,
Tuscarawas, Union, Van Wert, Vinton,
Warren, Washington, Wayne, Williams,
Wood and Wyandot

Heavy Construction

Highway Construction

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026
2	05/20/2026
3	06/25/2026

BROH001-001 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (DEFIANCE, FULTON (EXCLUDING FULTON, AMBOY & SWAN CREEK TOWNSHIPS), HENRY (EXCLUDING MONROE, BARTLOW, LIBERTY, WASHINGTON, RICHFIELD, MARION, DAMASCUS & TOWNSHIPS & THAT PART OF HARRISON TOWNSHIP OUTSIDE CORPORATE LIMITS OF CITY OF NAPOLEON), PAULDING, PUTNAM AND WILLIAMS COUNTIES).....	\$ 33.39	20.06

BROH001-004 06/01/2023		
	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER.....	\$ 32.40	19.30

BROH003-002 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (FULTON (TOWNSHIPS OF AMBOY, SWAN CREEK & FULTON), HENRY (TOWNSHIPS OF WASHINGTON, DAMASCUS, RICHFIELD, BARTLOW, LIBERTY, HARRISON, MONROE, & MARION), LUCAS AND WOOD (TOWNSHIPS OF PERRYSBURG, ROSS, LAKE, TROY, FREEDOM, MONTGOMERY, WEBSTER, CENTER, PORTAGE, MIDDLETON, PLAIN, LIBERTY, HENRY, WASHINGTON, WESTON, MILTON, JACKSON & GRAND RAPIDS) COUNTIES)...	\$ 33.39	20.06

BROH005-003 06/01/2020		
	Rates	Fringes
BRICKLAYER: BRICKLAYERS; CAULKERS; CLEANERS; POINTERS; & STONEMASONS (CUYAHOGA, LORAIN & MEDINA (HINCKLEY, GRANGER, BRUNSWICK, LIVERPOOL,		

MONTVILLE, YORK, HOMER, HARRISVILLE, CHATHAM, LITCHFIELD & SPENCER TOWNSHIPS AND THE CITY OF MEDINA)).....\$ 36.64	17.13
BRICKLAYER: SANDBLASTERS (CUYAHOGA, LORAIN & MEDINA (HINCKLEY, GRANGER, BRUNSWICK, LIVERPOOL, MONTVILLE, YORK, HOMER, HARRISVILLE, CHATHAM, LITCHFIELD & SPENCER TOWNSHIPS AND THE CITY OF MEDINA)).....\$ 36.39	17.13
BRICKLAYER: SEWER BRICKLAYERS & STACK BUILDERS (CUYAHOGA, LORAIN & MEDINA (HINCKLEY, GRANGER, BRUNSWICK, LIVERPOOL, MONTVILLE, YORK, HOMER, HARRISVILLE, CHATHAM, LITCHFIELD & SPENCER TOWNSHIPS AND THE CITY OF MEDINA)).....\$ 36.64	17.13
BRICKLAYER: SWING SCAFFOLDS (CUYAHOGA, LORAIN & MEDINA (HINCKLEY, GRANGER, BRUNSWICK, LIVERPOOL, MONTVILLE, YORK, HOMER, HARRISVILLE, CHATHAM, LITCHFIELD & SPENCER TOWNSHIPS AND THE CITY OF MEDINA)).....\$ 37.14	17.13

BROH0006-005 06/01/2024	
Rates	Fringes
BRICKLAYER, STONEMASON (CARROLL, COLUMBIANA (KNOX, BUTLER, WEST & HANOVER TOWNSHIPS), STARK & TUSCARAWAS).....\$ 33.39	20.06

BROH0007-002 06/01/2024	
Rates	Fringes
BRICKLAYER, STONEMASON (LAWRENCE).....\$ 33.39	20.06

BROH0007-005 06/01/2023	
Rates	Fringes
BRICKLAYER (PORTAGE & SUMMIT).....\$ 32.40	19.30

BROH0007-010 06/01/2024	
Rates	Fringes
MASON - STONE (PORTAGE & SUMMIT).....\$ 33.39	20.06

BROH0008-001 06/01/2024	
Rates	Fringes
BRICKLAYER (COLUMBIANA (SALEM, PERRY, FAIRFIELD, CENTER, ELK RUN, MIDDLETON, & UNITY TOWNSHIPS AND THE CITY OF NEW WATERFORD), MAHONING & TRUMBULL)....\$ 33.39	20.06

BROH0009-002 06/01/2024	
Rates	Fringes
BRICKLAYER, STONEMASON (BELMONT & MONROE COUNTIES AND THE TOWNSHIPS OF WARREN & MT. PLEASANT AND THE VILLAGE OF DILLONVALE IN JEFFERSON COUNTY).....\$ 33.39	20.06
REFRACTORY (BELMONT & MONROE COUNTIES AND THE TOWNSHIPS OF WARREN & MT. PLEASANT AND THE VILLAGE OF DILLONVALE IN JEFFERSON COUNTY).....\$ 31.45	19.01

BROH0010-002 06/01/2024	
Rates	Fringes
BRICKLAYER, STONEMASON (COLUMBIANA (ST. CLAIR, MADISON, WAYNE, FRANKLIN, WASHINGTON, YELLOW CREEK & LIVERPOOL TOWNSHIPS) & JEFFERSON (BRUSH CREEK & SALINE TOWNSHIPS)).....\$ 33.39	20.06

BROH0014-002 06/01/2024	
Rates	Fringes
BRICKLAYER, STONEMASON (HARRISON & JEFFERSON (EXCEPT MT. PLEASANT, WARREN, BRUSH CREEK, SALINE & SALINEVILLE TOWNSHIPS & THE VILLAGE OF DILLONVALE)).\$ 33.39	20.06

BROH0016-002 06/01/2023	
Rates	Fringes
BRICKLAYER, STONEMASON (ASHTABULA, GEAUGA, AND LAKE COUNTIES).....\$ 32.40	19.30

BROH0018-002 06/01/2024	

	Rates	Fringes
BRICKLAYER, STONEMASON (BROWN, BUTLER, CLERMONT, HAMILTON, PREBLE (GASPER, DIXON, ISRAEL, LANIER, SOMERS & GRATIS TOWNSHIPS) & WARREN COUNTIES:)).....\$ 33.39		20.06

BROH0022-004 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HIGHLAND, LOGAN, MIAMI, MONTGOMERY, PREBLE (JACKSON, MONROE, HARRISON, TWIN, JEFFERSON & WASHINGTON TOWNSHIPS) AND SHELBY COUNTIES)).....\$ 33.39		20.06

BROH0032-001 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (GALLIA & MEIGS)).....\$ 33.39		20.06

BROH0035-002 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (ALLEN, AUGLAIZE, MERCER AND VAN WERT COUNTIES)).....\$ 33.39		20.06

BROH0039-002 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (ADAMS & SCIOTO)).....\$ 33.39		20.06

BROH0040-003 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (ASHLAND, CRAWFORD, HARDIN, HOLMES, MARION, MORROW, RICHLAND, WAYNE AND WYANDOT (EXCEPT CRAWFORD, RIDGE, RICHLAND & TYMOCHTEE TOWNSHIPS) COUNTIES) FOOTNOTE: LAYOUT MAN AND SAWMAN RATE: \$1.00 PER HOUR ABOVE JOURNEYMAN RATE. FREE STANDING STACK WORK GROUND LEVEL TO TOP OF STACK; SANDBLASTING AND LAYING OF CARBON MASONRY MATERIAL IN SWING STAGE AND/OR SCAFFOLD; RAMMING AND SPADING OF PLASTICS AND GUNNITING: \$1.50 PER HOUR ABOVE JOURNEYMAN RATE. ""HOT"" WORK: \$2.50 ABOVE JOURNEYMAN RATE.....\$ 33.39		20.06

BROH0044-002 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (COSHOCOTON, FAIRFIELD, GUERNSEY, HOCKING, KNOX, KICKING, MORGAN, MUSKINGUM, NOBLE (BEAVER, BUFFALO, SENECA & WAYNE TOWNSHIPS) & PERRY COUNTIES:)).....\$ 33.39		20.06

BROH0045-002 06/01/2023		
	Rates	Fringes
BRICKLAYER, STONEMASON (FAYETTE, JACKSON, PIKE, ROSS AND VINTON COUNTIES)).....\$ 35.39		17.47

BROH0046-002 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (ERIE, HANCOCK, HURON, OTTAWA, SANDUSKY, SENECA, WOOD (PERRY & BLOOM TOWNSHIPS) AND WYANDOT (TYMOCHTEE, CRAWFORD, RIDGE & RICHLAND TOWNSHIPS) COUNTIES & THE ISLANDS OF LAKE ERIE NORTH OF SANDUSKY) FOOTNOTE: LAYOUT MAN AND SAWMAN RATE: \$1.00 PER HOUR ABOVE JOURNEYMAN RATE. FREE STANDING STACK WORK GROUND LEVEL TO TOP OF STACK; SANDBLASTING AND LAYING OF CARBON MASONRY MATERIAL IN SWING STAGE AND/OR SCAFFOLD; RAMMING AND SPADING OF PLASTICS AND GUNNITING: \$1.50 PER HOUR ABOVE JOURNEYMAN RATE. ""HOT"" WORK: \$2.50 ABOVE JOURNEYMAN RATE.....\$ 33.39		20.06

BROH0052-001 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (ATHENS COUNTY)).....\$ 33.39		20.06

BROH0052-003 06/01/2024		

	Rates	Fringes
BRICKLAYER, STONEMASON (NOBLE (BROOKFIELD, NOBLE, CENTER, SHARON, OLIVE, ENOCH, STOCK, JACKSON, JEFFERSON & ELK TOWNSHIPS) AND WASHINGTON COUNTIES).....	\$ 33.39	20.06

BROH0055-003 06/01/2024		
	Rates	Fringes
BRICKLAYER, STONEMASON (DELAWARE, FRANKLIN, MADISON, PICKAWAY AND UNION COUNTIES).....	\$ 33.39	20.06

CARP0002-024 05/01/2025		
	Rates	Fringes
CARPENTER & PILEDRIVERMEN (BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY & WARREN).....	\$ 35.94	23.59
DIVER (BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY & WARREN).....	\$ 40.58	9.69

CARP0171-001 05/01/2025		
	Rates	Fringes
CARPENTER (MAHONING & TRUMBULL).....	\$ 33.19	25.02

CARP0171-002 05/01/2025		
	Rates	Fringes
CARPENTER (BELMONT, COLUMBIANA, HARRISON, JEFFERSON & MONROE).....	\$ 32.50	26.19

CARP0200-002 05/01/2025		
	Rates	Fringes
CARPENTER (ADAMS, ATHENS, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GUERNSEY, HIGHLAND, HOCKING, JACKSON, LAWRENCE, LICKING, MADISON, MARION, MEIGS, MORGAN, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, ROSS, SCIOTO, UNION, VINTON AND WASHINGTON COUNTIES).....	\$ 35.94	23.59
DIVER (ADAMS, ATHENS, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GUERNSEY, HIGHLAND, HOCKING, JACKSON, LAWRENCE, LICKING, MADISON, MARION, MEIGS, MORGAN, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, ROSS, SCIOTO, UNION, VINTON AND WASHINGTON COUNTIES).....	\$ 39.41	10.40
PILEDRIVERMAN (ADAMS, ATHENS, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GUERNSEY, HIGHLAND, HOCKING, JACKSON, LAWRENCE, LICKING, MADISON, MARION, MEIGS, MORGAN, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, ROSS, SCIOTO, UNION, VINTON AND WASHINGTON COUNTIES).....	\$ 35.94	23.59

CARP0285-001 05/01/2025		
	Rates	Fringes
CARPENTER (CARROLL, STARK, TUSCARAWAS AND WAYNE)....	\$ 34.07	24.28

CARP0285-002 05/01/2025		
	Rates	Fringes
CARPENTER (COSHOCKTON, HOLMES, KNOX & MORROW).....	\$ 33.38	24.69

CARP0285-008 05/01/2025		
	Rates	Fringes
CARPENTER (MEDINA, PORTAGE & SUMMIT).....	\$ 37.18	25.07

CARP0351-005 05/01/2025		
	Rates	Fringes
CARPENTER (LUCAS & WOOD).....	\$ 35.44	27.56

CARP0351-006 05/01/2025		
	Rates	Fringes
CARPENTER (DEFIANCE, FULTON, HANCOCK, HENRY, PAULDING & WILLIAMS COUNTIES).....	\$ 32.05	26.13

CARP0372-002 05/01/2025		
	Rates	Fringes
CARPENTER (ALLEN, AUGLAIZE, HARDIN, MERCER, PUTNAM & VAN WERT).....	\$ 31.80	26.33

CARP0435-005 05/01/2025		
	Rates	Fringes
CARPENTER (ASHTABULA, CUYAHOGA, GEAUGA & LAKE).....	\$ 38.57	24.64

CARP0735-001 05/01/2025		
	Rates	Fringes
CARPENTER (ASHLAND, HURON & RICHLAND).....	\$ 34.67	23.57

CARP0735-002 05/01/2025		
	Rates	Fringes
CARPENTER (LORAIN).....	\$ 38.42	24.01

CARP0735-004 05/01/2025		
	Rates	Fringes
CARPENTER (ERIE).....	\$ 36.71	24.14

CARP0744-001 05/01/2025		
	Rates	Fringes
CARPENTER (CRAWFORD, OTTAWA, SANDUSKY, SENECA & WYANDOT).....	\$ 33.74	27.05

CARP1090-002 05/01/2025		
	Rates	Fringes
PILEDRIVERMEN & DIVER'S TENDER (ALLEN, AUGLAIZE, HARDIN, MERCER, PUTNAM, VAN WERT & WYANDOT) DIVERS - \$250.00 PER DAY.....	\$ 35.94	28.39

CARP1090-003 05/01/2025		
	Rates	Fringes
DIVER, WET (BELMONT, HARRISON, & MONROE).....	\$ 58.52	24.91
PILEDRIVERMEN; DIVER, DRY (BELMONT, HARRISON, & MONROE).....	\$ 39.01	24.91

CARP1090-004 05/01/2025		
	Rates	Fringes
DIVER, WET (CARROLL, STARK, TUSCARAWAS & WAYNE).....	\$ 49.82	25.40
PILEDRIVERMEN; DIVER, DRY (CARROLL, STARK, TUSCARAWAS & WAYNE).....	\$ 33.21	25.40

CARP1090-005 05/01/2025		
	Rates	Fringes
DIVER, WET (ASHLAND, ASHTABULA, CUYAHOGA, ERIE, GEAUGA, HURON, LAKE, LORAIN, MEDINA, PORTAGE, RICHLAND & SUMMIT).....	\$ 54.51	27.50
PILEDRIVERMEN; DIVER, DRY (ASHLAND, ASHTABULA, CUYAHOGA, ERIE, GEAUGA, HURON, LAKE, LORAIN, MEDINA, PORTAGE, RICHLAND & SUMMIT).....	\$ 36.34	27.50

CARP1090-006 05/01/2025		
	Rates	Fringes
DIVER, WET (COSHOCOTON, HOLMES, KNOX & MORROW).....	\$ 54.36	22.54
PILEDRIVERMEN; DIVER, DRY (COSHOCOTON, HOLMES, KNOX & MORROW).....	\$ 36.24	22.54

CARP1090-007 05/01/2025		
	Rates	Fringes
DIVER, WET (MAHONING & TRUMBULL).....	\$ 50.85	24.82
PILEDRIVERMEN; DIVER, DRY (MAHONING & TRUMBULL).....	\$ 33.90	24.82

CARP1090-008 05/01/2025		
	Rates	Fringes
PILEDRIVERMAN (COLUMBIANA & JEFFERSON).....	\$ 39.01	24.91

CARP1090-009 05/01/2025		
	Rates	Fringes
PILED RIVERMEN & DIVER'S TENDER (CRAWFORD, DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, SANDUSKY, SENECA, WILLIAMS & WOOD) DIVERS - \$250.00 PER DAY.....	\$ 37.98	28.63

ELEC0008-002 05/27/2024		
	Rates	Fringes
CABLE SPLICER (DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD).....	\$ 38.98	18.96
ELECTRICIAN (DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD).....	\$ 48.40	25.24

ELEC0032-003 06/01/2025		
	Rates	Fringes
ELECTRICIAN (ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, SHELBY, VAN WERT & WYANDOT (CRAWFORD, JACKSON, MARSEILLES, MIFFLIN, RIDGELAND, RIDGE & SALEM TOWNSHIPS)).....	\$ 39.17	23.60

ELEC0038-002 04/28/2025		
	Rates	Fringes
ELECTRICIAN, EXCLUDING SOUND & COMMUNICATIONS WORK. (CUYAHOGA, GEAUGA (BAINBRIDGE, CHESTER & RUSSELL TOWNSHIPS) & LORAIN (COLUMBIA TOWNSHIP)) FOOTNOTES: A. 6 PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. B. 1 WEEK'S PAID VACATION FOR 1 YEAR'S SERVICE; 2 WEEKS' PAID VACATION FOR 2 OR MORE YEARS' SERVICE.....	\$ 46.63	24.92

ELEC0038-008 04/28/2025		
	Rates	Fringes
SOUND & COMMUNICATION TECHNICIAN: COMMUNICATIONS TECHNICIAN (CUYAHOGA, GEAUGA (BAINBRIDGE, CHESTER & RUSSELL TOWNSHIPS) & LORAIN (COLUMBIA TOWNSHIP)) FOOTNOTES: A. 6 PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. B. 1 WEEK'S PAID VACATION FOR 1 YEAR'S SERVICE; 2 WEEKS' PAID VACATION FOR 2 OR MORE YEARS' SERVICE.....	\$ 34.30	14.95
SOUND & COMMUNICATION TECHNICIAN: INSTALLER TECHNICIAN (CUYAHOGA, GEAUGA (BAINBRIDGE, CHESTER & RUSSELL TOWNSHIPS) & LORAIN (COLUMBIA TOWNSHIP)) FOOTNOTES: A. 6 PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. B. 1 WEEK'S PAID VACATION FOR 1 YEAR'S SERVICE; 2 WEEKS' PAID VACATION FOR 2 OR MORE YEARS' SERVICE.....	\$ 33.05	14.91

ELEC0064-003 11/30/2025		
	Rates	Fringes
ELECTRICIAN (COLUMBIANA (BUTLER, FAIRFIELD, PERRY, SALEM & UNITY TOWNSHIPS) MAHONING (AUSTINTOWN, BEAVER, BERLIN, BOARDMAN, CANFIELD, ELLSWORTH, COITSVILLE, GOSHEN, GREEN, JACKSON, POLAND, SPRINGFIELD & YOUNGSTOWN TOWNSHIPS), & TRUMBULL (HUBBARD & LIBERTY TOWNSHIPS)).....	\$ 41.49	21.81

ELEC0071-005 01/06/2025		
	Rates	Fringes
LINE CONSTRUCTION: EQUIPMENT OPERATOR: DOT/TRAFFIC SIGNAL & HIGHWAY LIGHTING PROJECTS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN).....	\$ 39.97	18.79
LINE CONSTRUCTION: EQUIPMENT OPERATOR: MUNICIPAL POWER/TRANSIT PROJECTS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN).....	\$ 49.46	21.60
LINE CONSTRUCTION: GROUNDMAN: DOT/TRAFFIC SIGNAL & HIGHWAY LIGHTING PROJECTS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN).....	\$ 31.10	16.40

LINE CONSTRUCTION: GROUNDMAN: MUNICIPAL POWER/TRANSIT PROJECTS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN).....	\$ 38.47	18.64
LINE CONSTRUCTION: LINEMEN/CABLE SPLICER: DOT/TRAFFIC SIGNAL & HIGHWAY LIGHTING PROJECTS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN).....	\$ 43.89	19.85
LINE CONSTRUCTION: LINEMEN/CABLE SPLICER: MUNICIPAL POWER/TRANSIT PROJECTS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN).....	\$ 54.96	23.09

ELEC0071-010 01/06/2025

	Rates	Fringes
LINE CONSTRUCTION: EQUIPMENT OPERATOR	\$ 40.44	17.71
LINE CONSTRUCTION: GROUNDMAN	\$ 29.07	14.97
LINE CONSTRUCTION: LINEMAN & CABLE SPLICERS	\$ 46.02	19.04

ELEC0082-002 12/02/2024

	Rates	Fringes
ELECTRICIAN (CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN (WAYNE, CLEAR CREEK & FRANKLIN TOWNSHIPS)).....	\$ 38.00	22.49

ELEC0082-006 11/25/2024

	Rates	Fringes
SOUND & COMMUNICATION TECHNICIAN: CABLE PULLER (CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN (WAYNE, CLEAR CREEK & FRANKLIN TOWNSHIPS)).	\$ 13.85	5.30
SOUND & COMMUNICATION TECHNICIAN: INSTALLER/TECHNICIAN (CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN (WAYNE, CLEAR CREEK & FRANKLIN TOWNSHIPS)).....	\$ 27.70	15.71

ELEC0129-003 02/24/2025

	Rates	Fringes
ELECTRICIAN (LORAIN (EXCEPT COLUMBIA TOWNSHIP) & MEDINA (LITCHFIELD & LIVERPOOL TOWNSHIPS)).....	\$ 42.95	18.81

ELEC0129-004 02/24/2025

	Rates	Fringes
ELECTRICIAN (ERIE & HURON (LYME, RIDGEFIELD, NORWALK, TOWNSEND, WAKEMAN, SHERMAN, PERU, BRONSON, HARTLAND, CLARKSFIELD, NORWICH, GREENFIELD, FAIRFIELD, FITCHVILLE & NEW LONDON TOWNSHIPS)).....	\$ 42.95	18.81

ELEC0141-003 06/02/2025

	Rates	Fringes
CABLE SPLICER (BELMONT COUNTY).....	\$ 42.94	27.74
ELECTRICIAN (BELMONT COUNTY).....	\$ 39.25	31.23

ELEC0212-003 11/26/2018

	Rates	Fringes
SOUND & COMMUNICATION TECHNICIAN (BROWN, CLERMONT & HAMILTON).....	\$ 24.35	10.99

ELEC0212-005 06/02/2025

	Rates	Fringes
ELECTRICIAN (BROWN, CLERMONT, AND HAMILTON COUNTIES).....	\$ 38.05	22.97

ELEC0245-001 08/26/2024

	Rates	Fringes
LINE CONSTRUCTION: EQUIPMENT OPERATOR (ALLEN, HARDIN, VAN WERT & WYANDOT (CRAWFORD, JACKSON, MARSEILLES, MIFFLIN, RICHLAND, RIDGE & SALEM TOWNSHIPS)) FOOTNOTE: A. HALF DAY'S PAID HOLIDAY: THE LAST 4 HOURS OF THE WORKDAY PRIOR TO CHRISTMAS OR NEW YEAR'S DAY.....	\$ 32.95	17.08
LINE CONSTRUCTION: GROUNDMAN TRUCK DRIVER (ALLEN, HARDIN, VAN WERT & WYANDOT (CRAWFORD, JACKSON, MARSEILLES, MIFFLIN, RICHLAND, RIDGE & SALEM TOWNSHIPS)): FOOTNOTE: A. HALF DAY'S PAID HOLIDAY: THE LAST 4 HOURS OF THE WORKDAY PRIOR TO		

CHRISTMAS OR NEW YEAR'S DAY.....	\$ 20.59	13.62
LINE CONSTRUCTION: LINEMAN (ALLEN, HARDIN, VAN WERT & WYANDOT (CRAWFORD, JACKSON, MARSEILLES, MIFFLIN, RICHLAND, RIDGE & SALEM TOWNSHIPS)) FOOTNOTE: A. HALF DAY'S PAID HOLIDAY: THE LAST 4 HOURS OF THE WORKDAY PRIOR TO CHRISTMAS OR NEW YEAR'S DAY.....		
	\$ 47.07	21.03

ELEC0245-003 01/01/2025

Rates

Fringes

LINE CONSTRUCTION: CABLE SPICER (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) : FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 53.90	23.19
LINE CONSTRUCTION: GROUNDMAN/TRUCK DRIVER (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 20.51	13.84
LINE CONSTRUCTION: HELI-ARC WELDING (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 47.17	21.31
LINE CONSTRUCTION: LINEMAN (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 46.87	21.22
LINE CONSTRUCTION: OPERATOR - CLASS 1 (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 37.50	18.60
LINE CONSTRUCTION: OPERATOR - CLASS 2 (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 32.81	17.29
LINE CONSTRUCTION: TRAFFIC SIGNAL & LIGHTING TECHNICIAN (DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, AND WOOD COUNTIES) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....	\$ 42.18	19.91

ELEC0245-004 01/01/2025

Rates

Fringes

LINE CONSTRUCTION: CABLE SPICER (ERIE COUNTY)
 FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY;
 MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY;
 THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO
 WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE
 THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR
 THE WORK PERFORMED ON SUCH HOLIDAY.....\$ 53.90 23.19

LINE CONSTRUCTION: GROUNDMAN/TRUCK DRIVER (ERIE
 COUNTY) FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW
 YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR
 DAY; THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES
 WHO WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF
 DOUBLE THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME
 RATES FOR THE WORK PERFORMED ON SUCH HOLIDAY.....\$ 20.51 13.84

LINE CONSTRUCTION: LINEMAN (ERIE COUNTY)
 FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY;
 MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY;
 THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO
 WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE
 THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR
 THE WORK PERFORMED ON SUCH HOLIDAY.....\$ 46.87 21.22

LINE CONSTRUCTION: OPERATOR - CLASS 1 (ERIE COUNTY)
 FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S DAY;
 MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY;
 THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO
 WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE
 THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR
 THE WORK PERFORMED ON SUCH HOLIDAY.....\$ 37.50 18.60

LINE CONSTRUCTION: OPERATOR - CLASS 2 (ERIE COUNTY)
 FOOTNOTE: A. 6 OBSERVED HOLIDAYS: NEW YEAR'S
 DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY;
 THANKSGIVING DAY; & CHRISTMAS DAY. EMPLOYEES WHO
 WORK ON A HOLIDAY SHALL BE PAID AT A RATE OF DOUBLE
 THEIR APPLICABLE CLASSIFIED STRAIGHT-TIME RATES FOR
 THE WORK PERFORMED ON SUCH HOLIDAY.....\$ 32.81 17.29

ELEC0246-001 10/28/2024

Rates

Fringes

ELECTRICIAN (CARROLL, COLUMBIANA, HARRISON AND
 JEFFERSON COUNTIES) FOOTNOTE: A. 1 1/2 PAID
 HOLIDAYS: THE LAST SCHEDULED WORKDAY PRIOR TO
 CHRISTMAS & 4 HOURS ON GOOD FRIDAY.....\$ 44.00 37.68

ELEC0306-005 05/27/2024

Rates

Fringes

CABLE SPICER (MEDINA (BRUNSWICK, CHATHAM, GRANGER,
 GUILFORD, HARRISVILLE, HINCKLEY, HOMER, LAFAYETTE,
 MEDINA, MONTVILLE, SHARON, SPENCER, WADSWORTH,
 WESTFIELD & YORK TOWNSHIPS), PORTAGE (ATWATER,
 AURORA, BRIMFIELD, DEERFIELD, FRANKLIN, MANTUA,
 RANDOLPH, RAVENNA, ROOTSTOWN, SHALERSVILLE,
 STREETSBORO & SUFFIELD TOWNSHIPS), SUMMIT & WAYNE
 (BAUGHMAN, CANAAN, CHESTER, CHIPPEWA, CONGRESS,
 GREEN, MILTON, & WAYNE TOWNSHIPS)).....\$ 46.81 20.95

ELECTRICIAN (MEDINA (BRUNSWICK, CHATHAM, GRANGER,
 GUILFORD, HARRISVILLE, HINCKLEY, HOMER, LAFAYETTE,
 MEDINA, MONTVILLE, SHARON, SPENCER, WADSWORTH,
 WESTFIELD & YORK TOWNSHIPS), PORTAGE (ATWATER,
 AURORA, BRIMFIELD, DEERFIELD, FRANKLIN, MANTUA,
 RANDOLPH, RAVENNA, ROOTSTOWN, SHALERSVILLE,
 STREETSBORO & SUFFIELD TOWNSHIPS), SUMMIT & WAYNE
 (BAUGHMAN, CANAAN, CHESTER, CHIPPEWA, CONGRESS,
 GREEN, MILTON, & WAYNE TOWNSHIPS)).....\$ 42.55 20.95

ELEC0317-002 06/02/2025

Rates

Fringes

CABLE SPICER (GALLIA & LAWRENCE).....\$ 32.68 18.13
 ELECTRICIAN (GALLIA & LAWRENCE).....\$ 41.15 29.35

ELEC0540-005 06/30/2025

Rates

Fringes

ELECTRICIAN (CARROLL (NORTHERN HALF, INCLUDING FOX,
 HARRISON, ROSE & WASHINGTON TOWNSHIPS),
 COLUMBIANA (KNOX TOWNSHIP), HOLMES, MAHONING
 (SMITH TOWNSHIP), STARK, TUSCARAWAS (NORTH OF

AUBURN, CLAY, RUSH & YORK TOWNSHIPS), AND WAYNE (SOUTH OF BAUGHMAN, CHESTER, GREEN & WAYNE TOWNSHIPS) COUNTIES).....\$ 39.86		29.19

ELEC0573-003 06/01/2025	Rates	Fringes
ELECTRICIAN (ASHTABULA (COLEBROOK, WAYNE, WILLIAMSFIELD, ORWELL & WINDSOR TOWNSHIPS), GEAUGA (AUBURN, MIDDLEFIELD, PARKMAN & TROY TOWNSHIPS), MAHONING (MILTON TOWNSHIP), PORTAGE (CHARLESTOWN, EDINBURG, FREEDOM, HIRAM, NELSON, PALMYRA, PARIS & WINDHAM TOWNSHIPS), AND TRUMBULL (EXCEPT LIBERTY & HUBBARD TOWNSHIPS)).....\$ 42.20		23.37

ELEC0575-001 05/29/2023	Rates	Fringes
ELECTRICIAN (ADAMS, FAYETTE, HIGHLAND, HOCKING, JACKSON (BLOOMFIELD, FRANKLIN, HAMILTON, JEFFERSON, LICK, MADISON, SCIOTO, COAL, JACKSON, LIBERTY, MILTON & WASHINGTON TOWNSHIPS), PICKAWAY (DEER CREEK, PERRY, PICKAWAY, SALT CREEK & WAYNE TOWNSHIPS), PIKE (BEAVER, BENTON, JACKSON, MIFFLIN, PEBBLE, PEEPEE, PERRY, SEAL, CAMP CREEK, NEWTON, SCIOTO, SUNFISH, UNION & MARION TOWNSHIPS), ROSS, SCIOTO & VINTON (CLINTON, EAGLE, ELK, HARRISON, JACKSON, RICHLAND & SWAN TOWNSHIPS)).....\$ 37.00		22.26

ELEC0648-001 09/01/2025	Rates	Fringes
CABLE SPLICER (BUTLER AND WARREN COUNTIES (DEERFIELD, HAMILTON, HARLAN, MASSIE, SALEM, TURTLE CREEK, UNION & WASHINGTON TOWNSHIPS)).....\$ 30.50		18.23
ELECTRICIAN (BUTLER AND WARREN COUNTIES (DEERFIELD, HAMILTON, HARLAN, MASSIE, SALEM, TURTLE CREEK, UNION & WASHINGTON TOWNSHIPS)).....\$ 38.00		24.16

ELEC0673-004 05/26/2025	Rates	Fringes
CABLE SPLICER (ASHTABULA (EXCLUDING ORWELL, COLEBROOK, WILLIAMSFIELD, WAYNE & WINDSOR TOWNSHIPS), GEAUGA (BURTON, CHARDON, CLARIDON, HAMB DEN, HUNTSBURG, MONTVILLE, MUNSON, NEWBURY & THOMPSON TOWNSHIPS) AND LAKE COUNTIES).....\$ 33.81		21.47
ELECTRICIAN (ASHTABULA (EXCLUDING ORWELL, COLEBROOK, WILLIAMSFIELD, WAYNE & WINDSOR TOWNSHIPS), GEAUGA (BURTON, CHARDON, CLARIDON, HAMB DEN, HUNTSBURG, MONTVILLE, MUNSON, NEWBURY & THOMPSON TOWNSHIPS) AND LAKE COUNTIES).....\$ 41.17		24.58

ELEC0683-002 06/02/2025	Rates	Fringes
CABLE SPLICER (CHAMPAIGN, CLARK, DELAWARE, FAIRFIELD, FRANKLIN, MADISON, PICKAWAY (CIRCLEVILLE, DARBY, HARRISON, JACKSON, MADISON, MONROE, MUHLENBERG, SCIOTO, WALNUT & WASHINGTON TOWNSHIPS), AND UNION COUNTIES).....\$ 44.00		26.40
ELECTRICIAN (CHAMPAIGN, CLARK, DELAWARE, FAIRFIELD, FRANKLIN, MADISON, PICKAWAY (CIRCLEVILLE, DARBY, HARRISON, JACKSON, MADISON, MONROE, MUHLENBERG, SCIOTO, WALNUT & WASHINGTON TOWNSHIPS), AND UNION COUNTIES).....\$ 43.00		26.37

ELEC0688-003 05/30/2022	Rates	Fringes
ELECTRICIAN (ASHLAND, CRAWFORD, HURON (RICHMOND, NEW HAVEN, RIPLEY & GREENWICH TOWNSHIPS), KNOX (LIBERTY, CLINTON, UNION, HOWARD, MONROE, MIDDLEBERRY, MORRIS, WAYNE, BERLIN, PIKE, BROWN & JEFFERSON TOWNSHIPS), MARION, MORROW, RICHLAND AND WYANDOT (SYCAMORE, CRANE, EDEN, PITT, ANTRIM & TYMOCHTEE TOWNSHIPS) COUNTIES).....\$ 32.30		21.83

ELEC0972-002 06/01/2024	Rates	Fringes

CABLE SPLICER (ATHENS, MEIGS, MONROE, MORGAN, NOBLE, VINTON (BROWN, KNOX, MADISON, VINTON & WILKESVILLE TOWNSHIPS), AND WASHINGTON COUNTIES)...	\$ 40.25	33.33
ELECTRICIAN (ATHENS, MEIGS, MONROE, MORGAN, NOBLE, VINTON (BROWN, KNOX, MADISON, VINTON & WILKESVILLE TOWNSHIPS), AND WASHINGTON COUNTIES).....	\$ 40.00	33.32

ELEC1105-001 05/27/2024

Rates

Fringes

ELECTRICIAN (COSHOCOTON, GUERNSEY, KNOX (JACKSON, CLAY, MORGAN, MILLER, MILFORD, HILLIAR, BUTLER, HARRISON, PLEASANT & COLLEGE TOWNSHIPS), LICKING, MUSKINGUM, PERRY, AND TUSCARAWAS (AUBURN, YORK, CLAY, JEFFERSON, RUSH, OXFORD, WASHINGTON, SALEM, PERRY & BUCKS TOWNSHIPS) COUNTIES).....	\$ 39.60	24.41

ENGI0018-003 05/01/2024

Rates

Fringes

POWER EQUIPMENT OPERATOR: GROUP 1- AIR COMPRESSOR ON STEEL ERECTION; BARRIER MOVING MACHINE; BOILER OPERATOR ON COMPRESSOR OR GENERATOR WHEN MOUNTED ON A RIG; CABLEWAY; COMBINATION CONCRETE MIXER & TOWER; CONCRETE PLANT (OVER 4 YD. CAPACITY); CONCRETE PUMP; CRANE (ALL TYPES, INCLUDING BOOM TRUCK, CHERRY PICKER); CRANE-COMPACT, TRACK OR RUBBER OVER 4,000 LBS. CAPACITY; CRANES-SELF ERECTING, STATIONARY, TRACK OR TRUCK (ALL CONFIGURATIONS); DERRICK; DRAGLINE; DREDGE (DIPPER, CLAM OR SUCTION); ELEVATING GRADER OR EUCLID LOADER; FLOATING EQUIPMENT (ALL TYPES); GRADALL; HELICOPTER CREW (OPERATOR-HOIST OR WINCH); HOE (ALL TYPES); HOISTING ENGINE ON SHAFT OR TUNNEL WORK; HYDRAULIC GANTRY (LIFTING SYSTEM); INDUSTRIAL-TYPE TRACTOR; JET ENGINE DRYER (D8 OR D9) DIESEL TRACTOR; LOCOMOTIVE (STANDARD GAUGE); MAINTENANCE OPERATOR CLASS A; MIXER, PAVING (SINGLE OR DOUBLE DRUM); MUCKING MACHINE; MULTIPLE SCRAPER; PILEDRIVING MACHINE (ALL TYPES); POWER SHOVEL; PRENTICE LOADER; QUAD 9 (DOUBLE PUSHER); RAIL TAMPER (WITH AUTO LIFTING & ALIGNING DEVICE); REFRIGERATING MACHINE (FREEZER OPERATION); ROTARY DRILL, ON CAISSON WORK; ROUGH TERRAIN FORK LIFT WITH WINCH/HOIST; SIDE-BOOM; SLIP-FORM PAVES; TOWER DERRICK; TREE SHREDDER; TRENCH MACHINE (OVER 24" WIDE); TRUCK MOUNTED CONCRETE PUMP; TUG BOAT; TUNNEL MACHINE AND/OR MINING MACHINE; WHEEL EXCAVATOR; AND ASPHALT PLANT ENGINEER (CLEVELAND DISTRICT ONLY). (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).....	\$ 45.63	16.41
POWER EQUIPMENT OPERATOR: GROUP 2- ASPHALT PAVES; AUTOMATIC SUBGRADER MACHINE, SELF-PROPELLED (CMI TYPE); BOBCAT TYPE AND/OR SKID STEER LOADER WITH HOE ATTACHMENT GREATER THAN 7,000 LBS.; BORING MACHINE MORE THAN 48"; BULLDOZER; ENDLOADER; HORIZONTAL DIRECTIONAL DRILL (OVER 50,000 FT LBS THRUST); HYDRO MILLING MACHINE; KOLMAN-TYPE LOADER (PRODUCTION TYPE-DIRT); LEAD GREASEMAN; LIGHTING & TRAFFIC SIGNAL INSTALLATION EQUIPMENT (INCLUDES ALL GROUPS OR CLASSIFICATIONS); MATERIAL TRANSFER EQUIPMENT (SHUTTLE BUGGY) ASPHALT; PETTIBONE-RAIL EQUIPMENT; POWER GRADER; POWER SCRAPER; PUSH CAT; ROTOMILL (ALL), GRINDERS & PLANERS OF ALL TYPES; TRENCH MACHINE (24" WIDE & UNDER); VERMEER TYPE CONCRETE SAW; AND MAINTENANCE OPERATORS (PORTAGE AND SUMMIT COUNTIES ONLY). (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).....	\$ 45.53	16.41
POWER EQUIPMENT OPERATOR: GROUP 3- A-FRAME; AIR COMPRESSOR ON TUNNEL WORK (LOW PRESSURE); ASPHALT PLANT ENGINEER (PORTAGE AND SUMMIT COUNTIES ONLY); BOBCAT-TYPE AND/OR SKID STEER LOADER WITH OR WITHOUT ATTACHMENTS; HIGHWAY DRILLS (ALL TYPES); LOCOMOTIVE (NARROW GAUGE); MATERIAL HOIST/ELEVATOR; MIXER, CONCRETE (MORE THAN ONE BAG CAPACITY); MIXER, ONE BAG CAPACITY (SIDE LOADER); POWER BOILER (OVER 15 LBS. PRESSURE) PUMP OPERATOR INSTALLING & OPERATING WELL POINTS; PUMP (4" & OVER DISCHARGE); ROLLER, ASPHALT; ROTOVATOR (LIME SOIL STABILIZER);		

SWITCH & TIE TAMPERS (WITHOUT LIFTING & ALIGNING DEVICE); UTILITY OPERATOR (SMALL EQUIPMENT); WELDING MACHINES; AND RAILROAD TIE INSERTER/REMOVER; ARTICULATING/STRAIGHT BED END DUMPS IF ASSIGNED (MINUS \$4.00 PER HOUR). (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).....\$ 44.49	16.41
POWER EQUIPMENT OPERATOR: GROUP 4- BACKFILLER; BALLAST RE-LOCATOR; BARS, JOINT & MESH INSTALLING MACHINE; BATCH PLANT; BORING MACHINE OPERATOR (48" OR LESS); BULL FLOATS; BURLAP & CURING MACHINE; CONCRETE PLANT (CAPACITY 4 YD. & UNDER); CONCRETE SAW (MULTIPLE); CONVEYOR (HIGHWAY); CRUSHER; DECKHAND; FARM-TYPE TRACTOR WITH ATTACHMENTS (HIGHWAY); FINISHING MACHINE; FIREPERSON, FLOATING EQUIPMENT (ALL TYPES); FORKLIFT; FORM TRENCHER; HYDRO HAMMER EXPECT MASONARY; HYDRO SEEDER; PAVEMENT BREAKER; PLANT MIXER; POST DRIVER; POST HOLE DIGGER (POWER AUGER); POWER BRUSH BURNER; POWER FORM HANDLING EQUIPMENT; ROAD WIDENING TRENCHER; ROLLER (BRICK, GRADE & MACADAM); SELF-PROPELLED POWER SPREADER; SELF-PROPELLED POWER SUBGRADER; STEAM FIREPERSON; TRACTOR (PULLING SHEEPFOOT, ROLLER OR GRADER); AND VIBRATORY COMPACTOR WITH INTEGRAL POWER. (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).....\$ 43.27	16.41
POWER EQUIPMENT OPERATOR: GROUP 5- COMPRESSOR (PORTABLE, SEWER, HEAVY & HIGHWAY); DRUM FIREPERSON (ASPHALT PLANT); GENERATOR; MASONRY FORK LIFT; INBOARD-OUTBOARD MOTOR BOAT LAUNCH; OIL HEATER (ASPHALT PLANT); OILER/HELPER; POWER DRIVEN HEATER; POWER SWEEPER & SCRUBBER; PUMP (UNDER 4" DISCHARGE); SIGNALPERSON; TIRE REPAIRPERSON; VAC/ALLS; CRANES - COMPACT, TRACK OR RUBBER UNDER 4,000 POUND CAPACITY; FUELING AND GREASING; AND CHAINMEN. (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).\$ 37.98	16.41
POWER EQUIPMENT OPERATOR: GROUP 6- MASTER MECHANIC & BOOM FROM 150 TO 180. (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).....\$ 46.63	16.41
POWER EQUIPMENT OPERATOR: GROUP 7- BOOM FROM 180 AND OVER. (ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, AND SUMMIT COUNTIES).\$ 46.63	16.41

ENGI0018-004 05/01/2024

Rates

Fringes

POWER EQUIPMENT OPERATOR: GROUP 1- AIR COMPRESSOR
ON STEEL ERECTION; BARRIER MOVING MACHINE; BOILER
OPERATOR ON COMPRESSOR OR GENERATOR WHEN MOUNTED ON
A RIG; CABLEWAY; COMBINATION CONCRETE MIXER &
TOWER; CONCRETE PLANT (OVER 4 YD. CAPACITY);
CONCRETE PUMP; CRANE (ALL TYPES, INCLUDING BOOM
TRUCK, CHERRY PICKER); CRANE-COMPACT, TRACK OR
RUBBER OVER 4,000 LBS. CAPACITY; CRANES-SELF
ERECTING, STATIONARY, TRACK OR TRUCK (ALL
CONFIGURATIONS); DERRICK; DRAGLINE; DREDGE (DIPPER,
CLAM, OR SUCTION); ELEVATING GRADER OR EUCLID
LOADER; FLOATING EQUIPMENT (ALL TYPES); GRADALL;
HELICOPTER CREW (OPERATOR-HOIST OR WINCH); HOE (ALL
TYPES); HOISTING ENGINE ON SHAFT OR TUNNEL WORK;
HYDRAULIC GANTRY (LIFTING SYSTEM); INDUSTRIAL-TYPE
TRACTOR; JET ENGINE DRYER (D8 OR D9) DIESEL
TRACTOR; LOCOMOTIVE (STANDING GAUGE); MAINTENANCE
OPERATOR CLASS A; MIXER, PAVING (SINGLE OR DOUBLE
DRUM); MUCKING MACHINE; MULTIPLE SCRAPER;
PILEDIVING MACHINE (ALL TYPES); POWER SHOVEL;
PRENTICE LOADER; QUAD 9 (DOUBLE PUSHER); RAIL
TAMPER (WITH AUTO LIFTING & ALIGNING DEVICE);
REFRIGERATING MACHINE (FREEZER OPERATION); ROTARY
DRILL, ON CAISSON WORK; ROUGH TERRAIN FORK LIFT
WITH WINCH/HOIST; SIDE-BOOM; SLIP-FORM PAVER; TOWER
DERRICK; TREE SHREDDER; TRENCH MACHINE (OVER 24"
WIDE); TRUCK MOUNTED CONCRETE PUMP; TUG BOAT;
TUNNEL MACHINE AND/OR MINING MACHINE; AND WHEEL
EXCAVATOR. (ADAMS, ALLEN, ASHLAND, ATHENS,
AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL,
CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON,
CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD,

FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 44.14 16.41

POWER EQUIPMENT OPERATOR: GROUP 2- ASPHALT PAVER; AUTOMATIC SUBGRADER MACHINE, SELF-PROPELLED (CMI TYPE); BOBCAT TYPE AND/OR SKID STEER LOADER WITH HOE ATTACHMENT GREATER THAN 7,000 LBS.' BORING MACHINE MORE THAN 48""; BULLDOZER; ENDLOADER; HYDRO MILLING MACHING; HORIZONTAL DIRECTIONAL DRILL (OVER 50,000 FT. LBS. THRUST); KOLMAN-TYPE LOADER (PRODUCTION TYPE-DIRT); LEAD GREASEMAN; LIGHTING & TRAFFIC SIGNAL INSTALLATION EQUIPMENT (INCLUDES ALL GROUPS OR CLASSIFICATIONS); MATERIAL TRANSFER EQUIPMENT (SHUTTLE BUGGY); ASPHALT; PETTIBONE-RAIL EQUIPMENT; POWER GRADER; POWER SCRAPER; PUSH CAT; ROTOMILL (ALL), GRINDERS & PLANERS OF ALL TYPES; TRENCH MACHINE (24"" WIDE & UNDER); AND VERMEER TYPE CONCRETE SAW. (ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 44.02 16.41

POWER EQUIPMENT OPERATOR: GROUP 3- A-FRAME; AIR COMPRESOR ON TUNNEL WORK (LOW PRESSURE); ASPHALT PLANT ENGINEER; BOBCAT-TYPE AND/OR SKID STEER LOADER WITH OR WITHOUT ATTACHMENTS; HIGHWAY DRILLS (ALL TYPES); LOCOMOTIVE (NARROW GAUGE); MATERIAL HOIST/ELEVATOR; MIXER, CONCRETE (MORE THAN ONE BAG CAPACITY); MIXER, ONE BAG CAPACITY (SIDE LOADER); POWER BOILER (OVER 15 LBS. PRESSURE) PUMP OPERATOR INSTALLING & OPERATING WELL POINTS; PUMP (4"" & OVER DISCHARGE); RAILROAD TIE INSERTER/REMOVER; ROLLER, ASPHALT; ROTOVATOR (LIME SOIL STABILIZER); SWITCH & TIE TAMPERS (WITHOUT LIFTING & ALIGNING DEVICE); UTILITY OPERATOR (SMALL EQUIPMENT); AND WELDING MACHINES; ARTICULATING/STRAIGHT BED END DUMPS IF ASSIGNED (MINUS \$4.00 PER HOUR). (ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 42.98 16.41

POWER EQUIPMENT OPERATOR: GROUP 4- BACKFILLER; BALLAST RE-LOCATOR; BARS, JOINT & MESH INSTALLING MACHINE; BATCH PLANT; BORING MACHINE OPERATOR (48"" OR LESS); BULL FLOATS; BURLAP & CURING MACHINE; CONCRETE PLANT (CAPACITY 4 YD. & UNDER); CONCRETE SAW (MULTIPLE); CONVEYOR (HIGHWAY); CRUSHER: DECKAHDND: FARM-TYPE TRACTOR WITH ATTACHMENTS (HIGHWAY); FINISHING MACHINE; FIREPERSON, FLOATING EQUIPMENT (ALL TYPES); FORK LIFT; FORM TRENCHER; HYDRO HAMMER EXCEPT MASONARY; HYDRO SEEDER; PAVEMENT BREAKER; PLANT MIXER; POST DRIVER; POST HOLE DIGGER (POWER AUGER); POWER BRUSH BURNER;

POWER FORM HANDLING EQUIPMENT; ROAD WIDENING TRENCHER; ROLLER (BRICK, GRADE, & MACADAM); SELF-PROPELLED POWER SPREADER; SELF-PROPELLED POWER SUBGRADER; STEAM FIREPERSON; TRACTOR (PULLING SHEEPFOOT, ROLLER, OR GRADER); AND VIBRATORY COMPACTOR WITH INTEGRAL POWER. (ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCOTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 41.80	16.41
POWER EQUIPMENT OPERATOR: GROUP 5- COMPRESSOR (PORTABLE, SEWER, HEAVY & HIGHWAY); DRUM FIREPERSON (ASPHALT PLANT); GENERATOR; MASONARY FORKLIFT; INBOARD-OUTBOARD MOTOR BOAT LAUNCH; OIL HEATER (ASPHALT PLANT); OILER/HELPER; POWER DRIVEN HEATER; POWER SWEEPER & SCRUBBER; PUMP (UNDER 4" DISCHARGE); SIGNALPERSON; TIRE REPAIRPERSON; VAC/ALLS; CRANES-COMPACT, TRACK, OR RUBBER UNDER 4,000 POUND CAPACITY; FUELING AND GREASING; AND CHAINMEN. (ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 36.34	16.41
POWER EQUIPMENT OPERATOR: GROUP 6- MASTER MECHANIC & BOOM FROM 150 TO 180. (ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 45.14	16.41
POWER EQUIPMENT OPERATOR: GROUP 7- BOOM FROM 180 AND OVER. (ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, AND YANDOT COUNTIES).....\$ 45.14	16.41

ENGI0066-023 06/01/2023

Rates

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POWER EQUIPMENT OPERATOR: ALL OTHER WORK GROUP 1-

RIG, PILE DRIVER OR CAISSON TYPE; & RIG, PILE HYDRAULIC UNIT ATTACHED. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 37.19 24.30

POWER EQUIPMENT OPERATOR: ALL OTHER WORK GROUP 2 - ASPHALT HEATER PLANER; BACKFILLER WITH DRAG ATTACHMENT; BACKHOE; BACKHOE WITH SHEAR ATTACHED; BACKHOE-REAR PIVOTAL SWING; BATCH PLANT-CENTRAL MIX CONCRETE; BATCH PLANT, PORTABLE CONCRETE; BERM BUILDER-AUTOMATIC; BOAT DERRICK; BOAT-TUG; BORING MACHINE ATTACHED TO TRACTOR; BULLCLAM; VULLDOZER; C.M.I. ROAD BUILDER & SIMILAR TYPE; CABLE PLACER & LATYER; CARRIER-STRADDLE; CARRYALL-SCRAPER OR SCOPP; CHICAGO BOOM; COMPACTOR WITH BLAD ATTACHED; CONCRETE SAW (VERMEER OR SIMILAR TYPE); CONCRETE SPREADER FINISHER; COMBINATION, BIDWELL MACHINE; CRANE; CRANE-ELECTRIC OVERHEAD; CRANE-ROUGH TERRAIN; CRANE-SIDE BOOM; CRANE-TRUCK; CRANE-TOWER; DERRICK-BOOM; DERRICK-CAR; DIGGER -WHEEL (NOT TRENCHER OR ROAD WIDENER); DOUBLE NINE; DRAG LINE; DREDGE; DRILL-KENNY OR SIMILAR TYPE; EASY POUR MEDIAN BARRIER MACHINE (OR SIMILAR TYPE); ELECTROMATIC; FRANKIE PILE; GRADALL; GRADER; GURRY; SELF-PROPELLED; HEAVY EQUIPMENT ROBOTICS OPERATOR/MECHANIC; HOIST-MONORAIL; HOIST-STATIONARY & MOBILE TRACTOR; HOIST, 2 OR 3 DRUM; HORIZONTAL DIRECTIONAL DRILL OPERATOR; JACKALL; JUMBO MACHINE; KOCAL & KUHLMAN; LAND-SEAGOING VEHICLE; LOADER, ELEVATING; LOADER, FRONT END; LOADER, SKID STEER; LOCOMOTIVE; MECHANIC/WELDER; METRO CHIP HARVESTER WITH BOO; MUCKING MACHINE; PAVER-ASPHALT FINISHING MACHINE; PAVER-ROAD CONCRETE; PAVER-SLIP FORM (C.M.I. OR SIMILAR); PLACE CRETE MACHINE WITH BOOM; POST DRIVER (CARRIER MOUNTED); POWER DRIVEN HYDRAULIC PUMP & JACK (WHEN USED IN SLIP FORM OR LIFT SLAB CONSTRUCTION); PUMP CRETE MACHINE; REGULATOR-BALLAST; HYRAULIC POWER UNIT NOT ATTACHED TO RIG FOR PILE DRILLINGS; RIGS-DRILLING; ROTO MILL OR SIMILAR FULL LANE (8' WIDE & OVER); ROTO MILL OR SIMILAR TYPE (UNDER 8'); SHOVEL; SLIP FORM CURB MACHINE; SPEEDWING; SPIKEMASTER; STONECRUSHER; TIE PULLER & LOADER; TIE TAMPER; TRACTOR-DOUBLE BOOM; TRACTOR WITH ATTACHMENTS; TRUCK-BOOM; TRUCK-TIRE; TRENCH MACHINE; TUNNEL MACHINE (MARK 21 JAVA OR SIMILAR) & WHIRLEY (OR SIMILAR TYPE) (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 36.92 24.30

POWER EQUIPMENT OPERATOR: ALL OTHER WORK GROUP 3 - ASPHALT PLANT; BENDING MACHINE (PIPELINE OR TYPE); BORING MACHINE, MOTOR DRIVEN; CHIP HARVESTER WITHOUT BOOM; CLEANING MACHINE, PIPELINE TYPE; COATING MACHINE, PIPELINE TYPE; COMPACTOR; CONCRETE BELT PLACER; CONCRETE FINISHER; CONCRETE PLANER OR ASPHALT; CONCRETE SPREADER; ELEVATOR; FORK LIFT (HOME BUILDING ONLY); FORK LIFT & LULLS; FORK LIFT WALK BEHIND (HOISTING OVER 1 BUCK HIGH); FORM LINE MACHINE; GREASE TRUCK OPERATOR; GROUT PUMP; GUNNITE MACHINE; HORIZONTAL DIRECTIONAL DRILL LOCATOR; SINGLE DRUM HOIST WITH OR WITHOUT TOWER; HUCK BOLTING MACHINE; HYDRAULIC SCAFFOLD (HOISTING BUILDING MATERIALS); PAVING BREAKER (SELF=PROPELLED OR RIDDEN); PIPE DREAM; POT FIREPERSON (POWER AGITATED); REFRIGERATION PLANT; ROAD WIDENER; ROLLER; SASGEN DERRICK; SEEDING MACHINE; SOIL STABILIZER (PUMP TYPE); SPRAY CURE MACHINE, SELF-PROPELLED; STRAW BLOWER MACHINE; SUB-GRADER; TUBE FINISHER OR BROOM C.M.I. OR SIMILAR TYPE; & TUGGER HOIST. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 32.06 24.30

POWER EQUIPMENT OPERATOR: ALL OTHER WORK GROUP 4 - AIR CURTAIN DESTRUCTOR & SIMILAR TYPE; BATCH PLANT-JOB RELATED; BOILER OPERATOR; COMPRESSOR; CONVEYOR; CURB BUILDER, SELF-PROPELLED; DRILL WAGON; GENERATOR SET; GENERATOR-STEAM; HEATER-PORTABLE POWER; HYDRAULIC MANIUPULATOR CRANE; JACK-HYDRAULIC POWER DRIVEN; JACK-HYARAULIC (RAILROAD); LADAVATOR; MINOR MACHINE OPERATOR; MIXER-CONCRETE; MULCHING MACHINE; PIN PULLER; POWER BROOM; PULVERIZER; PUMP; ROAD FINISHING MAHINC (PULL TYPE); SAW-CONCRETE-SELF-PROPELLED (HIGHWAY WORK); SIGNAL PERSON; SPRAY CURE MACHINE-MOTOR POWERED; STUMP CUTTER; TRACTOR; TRENCHER FORM; WATER BLASTER; STEAM JENNY; SYPHON;

VIBRATOR-GASOLINE; & WELDING MACHINE. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 28.77	24.30
POWER EQUIPMENT OPERATOR: ALL OTHER WORK GROUP 5 - BRAKEPERSON; FIREPERSON; & OILER. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 25.94	24.30
POWER EQUIPMENT OPERATOR: ASBESTOS; HAZARDOUS/TOXIC WASTE PROJECTS GROUP 1 - A & B- RIG, PILE DRIVER OR CAISSON TYPE; & RIG, PILE HYDRAULIC UNIT ATTACHED. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 44.63	24.30
POWER EQUIPMENT OPERATOR: ASBESTOS; HAZARDOUS/TOXIC WASTE PROJECTS GROUP 2 - A & B - ASPHALT HEATER PLANER; BACKFILLER WITH DRAG ATTACHMENT; BACKHOE; BACKHOE WITH SHEAR ATTACHED; BACKHOE-REAR PIVOTAL SWING; BATCH PLANT-CENTRAL MIX CONCRETE; BATCH PLANT, PORTABLE CONCRETE; BERM BUILDER-AUTOMATIC; BOAT DERRICK; BOAT-TUG; BORING MACHINE ATTACHED TO TRACTOR; BULLCLAM; VULLDOZER; C.M.I. ROAD BUILDER & SIMILAR TYPE; CABLE PLACER & LATYER; CARRIER-STRADDLE; CARRYALL-SCRAPER OR SCOPP; CHICAGO BOOM; COMPACTOR WITH BLAD ATTACHED; CONCRETE SAW (VERMEER OR SIMILAR TYPE); CONCRETE SPREADER FINISHER; COMBINATION, BIDWELL MACHINE; CRANE; CRANE-ELECTRIC OVERHEAD; CRANE-ROUGH TERRAIN; CRANE-SIDE BOOM; CRANE-TRUCK; CRANE-TOWER; DERRICK-BOOM; DERRICK-CAR; DIGGER -WHEEL (NOT TRENCHER OR ROAD WIDENER); DOUBLE NINE; DRAG LINE; DREDGE; DRILL-KENNY OR SIMILAR TYPE; EASY POUR MEDIAN BARRIER MACHINE (OR SIMILAR TYPE); ELECTROMATIC; FRANKIE PILE; GRADALL; GRADER; GURRY; SELF-PROPELLED; HEAVY EQUIPMENT ROBOTICS OPERATOR/MECHANIC; HOIST-MONORAIL; HOIST-STATIONARY & MOBILE TRACTOR; HOIST, 2 OR 3 DRUM; HORIZONTAL DIRECTIONAL DRILL OPERATOR; JACKALL; JUMBO MACHINE; KOCAL & KUHLMAN; LAND-SEAGOING VEHICLE; LOADER, ELEVATING; LOADER, FRONT END; LOADER, SKID STEER; LOCOMOTIVE; MECHANIC/WELDER; METRO CHIP HARVESTER WITH BOO; MUCKING MACHINE; PAVER-ASPHALT FINISHING MACHINE; PAVER-ROAD CONCRETE; PAVER-SLIP FORM (C.M.I. OR SIMILAR); PLACE CRETE MACHINE WITH BOOM; POST DRIVER (CARRIER MOUNTED); POWER DRIVEN HYDRAULIC PUMP & JACK (WHEN USED IN SLIP FORM OR LIFT SLAB CONSTRUCTION); PUMP CRETE MACHINE; REGULATOR-BALLAST; HYRAULIC POWER UNIT NOT ATTACHED TO RIG FOR PILE DRILLINGS; RIGS-DRILLING; ROTO MILL OR SIMILAR FULL LANE (8' WIDE & OVER); ROTO MILL OR SIMILAR TYPE (UNDER 8'); SHOVEL; SLIP FORM CURB MACHINE; SPEEDWING; SPIKEMASTER; STONECRUSHER; TIE PULLER & LOADER; TIE TAMPER; TRACTOR-DOUBLE BOOM; TRACTOR WITH ATTACHMENTS; TRUCK-BOOM; TRUCK-TIRE; TRENCH MACHINE; TUNNEL MACHINE (MARK 21 JAVA OR SIMILAR) & WHIRLEY (OR SIMILAR TYPE) (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 44.30	24.30
POWER EQUIPMENT OPERATOR: ASBESTOS; HAZARDOUS/TOXIC WASTE PROJECTS GROUP 3 - A & B - ASPHALT PLANT; BENDING MACHINE (PIPELINE OR TYPE); BORING MACHINE, MOTOR DRIVEN; CHIP HARVESTER WITHOUT BOOM; CLEANING MACHINE, PIPELINE TYPE; COATING MACHINE, PIPELINE TYPE; COMPACTOR; CONCRETE BELT PLACER; CONCRETE FINISHER; CONCRETE PLANER OR ASPHALT; CONCRETE SPREADER; ELEVATOR; FORK LIFT (HOME BUILDING ONLY); FORK LIFT & LULLS; FORK LIFT WALK BEHIND (HOISTING OVER 1 BUCK HIGH); FORM LINE MACHINE; GREASE TRUCK OPERATOR; GROUT PUMP; GUNNITE MACHINE; HORIZONTAL DIRECTIONAL DRILL LOCATOR; SINGLE DRUM HOIST WITH OR WITHOUT TOWER; HUCK BOLTING MACHINE; HYDRAULIC SCAFFOLD (HOISTING BUILDING MATERIALS); PAVING BREAKER (SELF=PROPELLED OR RIDDEN); PIPE DREAM; POT FIREPERSON (POWER AGITATED); REFRIGERATION PLANT; ROAD WIDENER; ROLLER; SASGEN DERRICK; SEEDING MACHINE; SOIL STABILIZER (PUMP TYPE); SPRAY CURE MACHINE, SELF-PROPELLED; STRAW BLOWER MACHINE; SUB-GRADER; TUBE FINISHER OR BROOM C.M.I. OR SIMILAR TYPE; & TUGGER HOIST(COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 38.47	24.30
POWER EQUIPMENT OPERATOR: ASBESTOS; HAZARDOUS/TOXIC WASTE PROJECTS GROUP 4 - A & B - AIR CURTAIN DESTRUCTOR & SIMILAR TYPE; BATCH PLANT-JOB RELATED; BOILER OPERATOR; COMPRESSOR; CONVEYOR; CURB BUILDER, SELF-PROPELLED; DRILL WAGON; GENERATOR SET; GENERATOR-STEAM; HEATER-PORTABLE POWER;	

HYDRAULIC MANIPLATOR CRANE; JACK-HYDRAULIC POWER
 DRIVEN; JACK-HYRAULIC (RAILROAD); LADAVATOR; MINOR
 MACHINE OPERATOR; MIXER-CONCRETE; MULCHING MACHINE;
 PIN PULLER; POWER BROOM; PULVERIZER; PUMP; ROAD
 FINISHING MAHINC (PULL TYPE);
 SAW-CONCRETE-SELF-PROPELLED (HIGHWAY WORK); SIGNAL
 PERSON; SPRAY CURE MACHINE-MOTOR POWERED; STUMP
 CUTTER; TRACTOR; TRENCHER FORM; WATER BLASTER;
 STEAM JENNY; SYPHON; VIBRATOR-GASOLINE; & WELDING
 MACHINE. (COLUMBIANA, MAHONING & TRUMBULL
 COUNTIES).....\$ 34.52 24.30
 POWER EQUIPMENT OPERATOR: ASBESTOS; HAZARDOUS/TOXIC
 WASTE PROJECTS GROUP 5 - A & B - BRAKEPERSON;
 FIREPERSON; & OILER. (COLUMBIANA, MAHONING &
 TRUMBULL COUNTIES).....\$ 31.13 24.30
 POWER EQUIPMENT OPERATOR: HAZARDOUS/TOXIC WASTE
 PROJECTS GROUP 1 - C & D - RIG, PILE DRIVER OR
 CAISSON TYPE; & RIG, PILE HYDRAULIC UNIT ATTACHED.
 (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....\$ 40.91 24.30
 POWER EQUIPMENT OPERATOR: HAZARDOUS/TOXIC WASTE
 PROJECTS GROUP 2 - C & D - ASPHALT HEATER PLANER;
 BACKFILLER WITH DRAG ATTACHMENT; BACKHOE; BACKHOE
 WITH SHEAR ATTACHED; BACKHOE-REAR PIVOTAL SWING;
 BATCH PLANT-CENTRAL MIX CONCRETE; BATCH PLANT,
 PORTABLE CONCRETE; BERM BUILDER-AUTOMATIC; BOAT
 DERRICK; BOAT-TUG; BORING MACHINE ATTACHED TO
 TRACTOR; BULLCLAM; VULLDOZER; C.M.I. ROAD BUILDER &
 SIMILAR TYPE; CABLE PLACER &LATYER;
 CARRIER-STRADDLE; CARRYALL-SCRAPER OR SCOPP;
 CHICAGO BOOM; COMPACTOR WITH BLAD ATTACHED;
 CONCRETE SAW (VERMEER OR SIMILAR TYPE); CONCRETE
 SPREADER FINISHER; COMBINATION, BIDWELL MACHINE;
 CRANE; CRANE-ELECTRIC OVERHEAD; CRANE-ROUGH
 TERRAIN; CRANE-SIDE BOOM; CRANE-TRUCK; CRANE-TOWER;
 DERRICK-BOOM; DERRICK-CAR; DIGGER -WHEEL (NOT
 TRENCHER OR ROAD WIDENER); DOUBLE NINE; DRAG LINE;
 DREDGE; DRILL-KENNY OR SIMILAR TYPE; EASY POUR
 MEDIAN BARRIER MACHINE (OR SIMILAR TYPE);
 ELECTROMATIC; FRANKIE PILE; GRADALL; GRADER; GURRY;
 SELF-PROPELLED; HEAVY EQUIPMENT ROBOTICS
 OPERATOR/MECHANIC; HOIST-MONORAIL; HOIST-STATIONARY
 & MOBILE TRACTOR; HOIST, 2 OR 3 DRUM; HORIZONTAL
 DIRECTIONAL DRILL OPERATOR; JACKALL; JUMBO MACHINE;
 KOCAL & KUHLMAN; LAND-SEAGOING VEHICLE; LOADER,
 ELEVATING; LOADER, FRONT END; LOADER, SKID STEER;
 LOCOMOTIVE; MECHANIC/WELDER; METRO CHIP HARVESTER
 WITH BOO; MUCKING MACHINE; PAVER-ASPHALT FINISHING
 MACHINE; PAVER-ROAD CONCRETE; PAVER-SLIP FORM
 (C.M.I. OR SIMILAR); PLACE CRETE MACHINE WITH BOOM;
 POST DRIVER (CARRIER MOUNTED); POWER DRIVEN
 HYDRAULIC PUMP & JACK (WHEN USED IN SLIP FORM OR
 LIFT SLAB CONSTRUCTION); PUMP CRETE MACHINE;
 REGULATOR-BALLAST; HYRAULIC POWER UNIT NOT ATTACHED
 TO RIG FOR PILE DRILLINGS; RIGS-DRILLING; ROTO MILL
 OR SIMILAR FULL LANE (8' WIDE & OVER); ROTO MILL OR
 SIMILAR TYPE (UNDER 8'); SHOVEL; SLIP FORM CURB
 MACHINE; SPEEDWING; SPIKEMASTER; STONECRUSHER; TIE
 PULLER & LOADER; TIE TAMPER; TRACTOR-DOUBLE BOOM;
 TRACTOR WITH ATTACHMENTS; TRUCK-BOOM; TRUCK-TIRE;
 TRENCH MACHINE; TUNNEL MACHINE (MARK 21 JAVA OR
 SIMILAR) & WHIRLEY (OR SIMILAR TYPE) (COLUMBIANA,
 MAHONING & TRUMBULL COUNTIES).....\$ 40.61 24.30
 POWER EQUIPMENT OPERATOR: HAZARDOUS/TOXIC WASTE
 PROJECTS GROUP 3 - C & D - ASPHALT PLANT; BENDING
 MACHINE (PIPELINE OR TYPE); BORING MACHINE, MOTOR
 DRIVEN; CHIP HARVESTER WITHOUT BOOM; CLEANING
 MACHINE, PIPELINE TYPE; COATING MACHINE, PIPELINE
 TYPE; COMPACTOR; CONCRETE BELT PLACER; CONCRETE
 FINISHER; CONCRETE PLANER OR ASPHALT; CONCRETE
 SPREADER; ELEVATOR; FORK LIFT (HOME BUILDING ONLY);
 FORK LIFT & LULLS; FORK LIFT WALK BEHIND (HOISTING
 OVER 1 BUCK HIGH); FORM LINE MACHINE; GREASE TRUCK
 OPERATOR; GROUT PUMP; GUNNITE MACHINE; HORIZONTAL
 DIRECTIONAL DRILL LOCATOR; SINGLE DRUM HOIST WITH
 OR WITHOUT TOWER; HUCK BOLTING MACHINE; HYDRAULIC
 SCAFFOLD (HOISTING BUILDING MATERIALS); PAVING
 BREAKER (SELF=PROPELLED OR RIDDEN); PIPE DREAM; POT
 FIREPERSON (POWER AGITATED); REFRIGERATION PLANT;
 ROAD WIDENER; ROLLER; SASGEN DERRICK; SEEDING
 MACHINE; SOIL STABILIZER (PUMP TYPE); SPRAY CURE
 MACHINE, SELF-PROPELLED; STRAW BLOWER MACHINE;

SUB-GRADER; TUBE FINISHER OR BROOM C.M.I. OR SIMILAR TYPE; & TUGGER HOIST(COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....	\$ 35.27	24.30
POWER EQUIPMENT OPERATOR: HAZARDOUS/TOXIC WASTE PROJECTS GROUP 4 - C & D - AIR CURTAIN DESTRUCTOR & SIMILAR TYPE; BATCH PLANT-JOB RELATED; BOILER OPERATOR; COMPRESSOR; CONVEYOR; CURB BUILDER, SELF-PROPELLED; DRILL WAGON; GENERATOR SET; GENERATOR-STEAM; HEATER-PORTABLE POWER; HYDRAULIC MANIUPULATOR CRANE; JACK-HYDRAULIC POWER DRIVEN; JACK-HYARULIC (RAILROAD); LADAVATOR; MINOR MACHINE OPERATOR; MIXER-CONCRETE; MULCHING MACHINE; PIN PULLER; POWER BROOM; PULVERIZER; PUMP; ROAD FINISHING MAHINC (PULL TYPE); SAW-CONCRETE-SELF-PROPELLED (HIGHWAY WORK); SIGNAL PERSON; SPRAY CURE MACHINE-MOTOR POWERED; STUMP CUTTER; TRACTOR; TRENCHER FORM; WATER BLASTER; STEAM JENNY; SYPHON; VIBRATOR-GASOLINE; & WELDING MACHINE. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....	\$ 31.65	24.30
POWER EQUIPMENT OPERATOR: HAZARDOUS/TOXIC WASTE PROJECTS GROUP 5 - C & D - BRAKEPERSON; FIREPERSON; & OILER. (COLUMBIANA, MAHONING & TRUMBULL COUNTIES).....	\$ 28.53	24.30

IRON0017-002 05/01/2024

Rates

Fringes

IRONWORKER: ORNAMENTAL, REINFORCING, & STRUCTURAL (ASHTABULA (NORTH OF ROUTE 6, STARTING AT THE GEAUGA COUNTY LINE, PROCEEDING EAST TO STATE ROUTE 45), CUYAHOGA, ERIE (EASTERN 2/3), GEAUGA, HURON (EAST OF A LINE DRAWN FROM THE NORTH BORDER THROUGH MONROEVILLE & WILLARD), LAKE, LORAIN, MEDINA (NORTH OF OLD RTE. #224), PORTAGE (WEST OF A LINE FROM MIDDLEFIELD TO SHALERSVILLE TO DEERFIELD), AND SUMMIT (NORTH OF OLD RTE. #224, INCLUDING CITY LIMITS OF BARBERTON) COUNTIES).....	\$ 36.83	29.01

IRON0017-010 05/01/2024

Rates

Fringes

IRONWORKER: STRUCTURAL, INCLUDING METAL BUILDING ERECTION & REINFORCING (ASHTABULA (EASTERN PART FROM LAKE ERIE ON THE NORTH TO ROUTE #322 ON THE SOUTH TO INCLUDE CONNEAUT, KINGSVILLE, SHEFFIELD, DENMARK, DORSET, CHERRY VALLEY, WAYNE, MONROE, PIERPONT, RICHMOND, ANDOVER & WILLIAMSFIELD TOWNSHIPS)).....	\$ 36.83	29.01

IRON0044-001 06/01/2025

Rates

Fringes

IRONWORKER, REINFORCING (ADAMS (WESTERN PART), BROWN, BUTLER (SOUTHERN PART), CLERMONT, CLINTON (SOUTH OF A LINE DRAWN FROM BLANCHESTER TO LYNCBURG), HAMILTON, HIGHLAND (EXCLUDING EASTERN ONE-FIFTH & PORTION OF COUNTY INSIDE LINES DRAWN FROM MARSHALL TO LYNCHBURG FROM THE NORTHERN COUNTY LINE THROUGH E. MONROE TO MARSHALL) AND WARREN (SOUTH OF A LINE DRAWN FROM BLANCHESTER THROUGH MORROW TO THE WEST COUNTY LINE) COUNTIES).....	\$ 38.27	23.90

IRON0044-002 06/01/2025

Rates

Fringes

IRONWORKER: FENCE ERECTOR (CLINTON (SOUTH OF A LINE DRAWN FROM BLANCHESTER TO LYNCHBURG), HAMILTON, HIGHLAND (EXCLUDING EASTERN ONE-FIFTH & PORTION OF COUNTY INSIDE LINES DRAWN FROM MARSHALL TO LYNCBURG FROM THE NORTHERN COUNTY LINE THROUGH E. MONROE TO MARSHALL) & WARREN (SOUTH OF A LINE DRAWN FROM BLANCHESTER THROUGH MORROW TO THE WEST COUNTY LINE)).....	\$ 35.88	23.90
IRONWORKER: ORNAMENTAL; STRUCTURAL (CLINTON (SOUTH OF A LINE DRAWN FROM BLANCHESTER TO LYNCHBURG), HAMILTON, HIGHLAND (EXCLUDING EASTERN ONE-FIFTH & PORTION OF COUNTY INSIDE LINES DRAWN FROM MARSHALL TO LYNCHBURG FROM THE NORTHERN COUNTY LINE THROUGH E. MONROE TO MARSHALL) & WARREN (SOUTH OF A LINE DRAWN FROM BLANCHESTER THROUGH MORROW TO THE WEST		

COUNTY LINE)).....\$ 37.77	23.90

IRON0055-003 07/01/2024	
	Rates Fringes
IRONWORKER: ALL OTHER WORK (CRAWFORD (AREA BETWEEN LINES DRAWN FROM WHERE HWY #598 & #30 MEET THROUGH N. LIBERTY TO THE NORTHERN BORDER & FROM SAID HWY JUNCTION POINT DUE WEST TO THE BORDER), DEFIANCE (S. OF A LINE DRAWN FROM WHERE RTE. #66 MEETS THE NORTHERN LINE THROUGH INDEPENDENCE TO THE EASTERN COUNTY BORDER), ERIE (WESTERN 1/3), FULTON, HANCOCK, HARDIN (NORTH OF A LINE DRAWN FROM MAYSVILLE TO A POINT 4 MILES SOUTH OF THE NORTHERN LINE ON THE EASTERN LINE), HENRY, HURON (WEST OF A.....\$ 29.77	21.30
IRONWORKER: FENCE ERECTOR (CRAWFORD (AREA BETWEEN LINES DRAWN FROM WHERE HWY #598 & #30 MEET THROUGH N. LIBERTY TO THE NORTHERN BORDER & FROM SAID HWY JUNCTION POINT DUE WEST TO THE BORDER), DEFIANCE (S. OF A LINE DRAWN FROM WHERE RTE. #66 MEETS THE NORTHERN LINE THROUGH INDEPENDENCE TO THE EASTERN COUNTY BORDER), ERIE (WESTERN 1/3), FULTON, HANCOCK, HARDIN (NORTH OF A LINE DRAWN FROM MAYSVILLE TO A POINT 4 MILES SOUTH OF THE NORTHERN LINE ON THE EASTERN LINE), HENRY, HURON (WEST OF A.....\$ 29.77	21.30
IRONWORKER: FLAT ROAD MESH (CRAWFORD (AREA BETWEEN LINES DRAWN FROM WHERE HWY #598 & #30 MEET THROUGH N. LIBERTY TO THE NORTHERN BORDER & FROM SAID HWY JUNCTION POINT DUE WEST TO THE BORDER), DEFIANCE (S. OF A LINE DRAWN FROM WHERE RTE. #66 MEETS THE NORTHERN LINE THROUGH INDEPENDENCE TO THE EASTERN COUNTY BORDER), ERIE (WESTERN 1/3), FULTON, HANCOCK, HARDIN (NORTH OF A LINE DRAWN FROM MAYSVILLE TO A POINT 4 MILES SOUTH OF THE NORTHERN LINE ON THE EASTERN LINE), HENRY, HURON (WEST OF A.....\$ 26.40	24.62
IRONWORKER: TUNNES & CAISSONS UNDER PRESSURE (CRAWFORD (AREA BETWEEN LINES DRAWN FROM WHERE HWY #598 & #30 MEET THROUGH N. LIBERTY TO THE NORTHERN BORDER & FROM SAID HWY JUNCTION POINT DUE WEST TO THE BORDER), DEFIANCE (S. OF A LINE DRAWN FROM WHERE RTE. #66 MEETS THE NORTHERN LINE THROUGH INDEPENDENCE TO THE EASTERN COUNTY BORDER), ERIE (WESTERN 1/3), FULTON, HANCOCK, HARDIN (NORTH OF A LINE DRAWN FROM MAYSVILLE TO A POINT 4 MILES SOUTH OF THE NORTHERN LINE ON THE EASTERN LINE), HENRY, HURON (WEST OF A.....\$ 35.50	29.20

IRON0147-002 06/01/2025	
	Rates Fringes
IRONWORKER (ALLEN (NORTHERN HALF), DEFIANCE (NORTHERN PART, EXCLUDING SOUTH OF A LINE DRAWN FROM WHERE RTE. #66 MEETS THE NORTHERN LINE THROUGH INDEPENDENCE TO THE EASTERN COUNTY BORDER), MERCER (NORTHERN HALF), PAULDING, PUTNAM (WESTERN PART, EXCLUDING EAST OF A LINE DRAWN FROM THE NORTHERN BORDER DOWN THROUGH MILLER CITY TO WHERE #696 MEETS THE SOUTHERN BORDER), VAN WERT, AND WILLIAMS (WESTERN PART, EXCLUDING EAST OF A LINE DRAWN FROM PIONEER THROUGH STRYKER TO THE SOUTHERN BORDER) COUNTIES).....\$ 38.00	26.39

IRON0172-002 06/01/2025	
	Rates Fringes
IRONWORKER (CHAMPAIGN (EASTERN ONE-THIRD), CLARK (EASTERN ONE-FOURTH), COSHOCTON (WEST OF A LINE BEGINNING AT THE NORTHWESTERN COUNTY LINE GOING THROUGH WALHONDING & TUNNEL HILL TO THE SOUTHERN COUNTY LINE), CRAWFORD (SOUTH OF RTE. #30), DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, HARDIN (EXCLUDING A LINE DRAWN FROM ROUNDHEAD TO MAYSVILLE), HIGHLAND (EASTERN ONE-FIFTH), HOCKING, JACKSON (NORTHERN HALF), KNOX, LICKING, LOGAN (EASTERN ONE-THIRD), MADISON, MARION, MORROW, MUSKINGUM (WEST OF A LINE.....\$ 40.87	23.15

IRON0207-004 06/01/2025

Rates Fringes

IRONWORKER: LAYOUT; SHEETER (ASHTABULA (SOUTHERN PART STARTING AT THE GEAUGA COUNTY LINE), COLUMBIANA (E. OF A LINE FROM DAMASCUS TO HIGHLANDTOWN), MAHONING (N. OF OLD ROUTE #224), PORTAGE (E. OF A LINE FROM MIDDLEFIELD TO SHALERSVILLE TO DEERFIELD) & TRUMBULL).....\$ 37.26 28.16

IRONWORKER: ORNAMENTAL; REINFORCING; STRUCTURAL (ASHTABULA (SOUTHERN PART STARTING AT THE GEAUGA COUNTY LINE), COLUMBIANA (E. OF A LINE FROM DAMASCUS TO HIGHLANDTOWN), MAHONING (N. OF OLD ROUTE #224), PORTAGE (E. OF A LINE FROM MIDDLEFIELD TO SHALERSVILLE TO DEERFIELD) & TRUMBULL).....\$ 36.26 28.16

IRON0290-002 06/01/2025

Rates Fringes

IRONWORKER (ALLEN (SOUTHERN HALF), AUGLAIZE, BUTLER (NORTH OF A LINE DRAWN FROM EAST TO THE WEST COUNTY LINE GOING THROUGH OXFORD, DARRTOWN & WOODSDALE), CHAMPAIGN (EXCLUDING EAST OF A LINE DRAWN FROM CATAWLA TO THE POINT WHERE #68 INTERSECTS THE NORTHERN COUNTY LINE), CLARK (WESTERN TWO-THIRDS), CLINTON (EXCLUDING SOUTH OF A LINE DRAWN FROM BLANCHESTER TO LYNCHBURG), DARKE, GREENE, HIGHLAND (INSIDE LINES DRAWN FROM MARSHALL TO LYNCHBURG & FROM THE NORTHERN COUNTY LINE THROUGH EA.....\$ 37.39 25.35

IRON0549-003 12/01/2022

Rates Fringes

IRONWORKER (BELMONT, GUERNSEY, HARRISON, JEFFERSON, MONROE & MUSKINGUM (EXCLUDING PORTION WEST OF A LINE STARTING AT ADAMS MILL GOING TO ADAMSVILLE AND GOING FROM ADAMSVILLE THROUGH BLUE ROCK TO THE SOUTH BORDER)).....\$ 35.19 25.66

IRON0550-004 05/01/2024

Rates Fringes

IRONWORKERS: STRUCTURAL, ORNAMENTAL AND REINFORCING (ASHLAND, CARROLL, COLUMBIANA (W. OF A LINE FROM DAMASCUS TO HIGHLANDTOWN), COSHOCTON (E. OF A LINE BEGINNING AT NW CO. LINE GOING THROUGH WALHONDING & TUNNEL HILL TO THE SOUTH CO. LINE), HOLMES, HURON (S. OF OLD RTE. #224), MAHONING (S. OF OLD RTE. #224), MEDINA (S. OF OLD RTE. #224), PORTAGE (S. OF OLD RTE. #224), RICHLAND, STARK, SUMMIT (S. OF OLD RTE. #224, EXCLUDING CITY LIMITS OF BARBERTON), TUSCARAWAS, & WAYNE).....\$ 34.70 22.88

IRON0769-004 06/01/2025

Rates Fringes

IRONWORKER (ADAMS (EASTERN HALF), GALLIA, JACKSON (SOUTHERN HALF), LAWRENCE & SCIOTO).....\$ 39.70 29.59

IRON0787-003 06/01/2025

Rates Fringes

IRONWORKER (ATHENS, MEIGS, MORGAN, NOBLE, AND WASHINGTON COUNTIES).....\$ 36.10 24.65

LABO0265-008 05/01/2024

Rates Fringes

LABORER GROUP 1- ASPHALT LABORER; CARPENTER TENDER; CONCRETE CURING APPLICATOR; DUMP MAN (BATCH TRUCK); GUARDRAIL AND FENCE INSTALLER; JOINT SETTER; LABORER (CONSTRUCTION); LANDSCAPE LABORER; MESH HANDLERS & PLACER; RIGHT-OF-WAY LABORER; RIPRAP LABORER & GROUTER; SCAFFOLD ERECTOR; SEAL COATING; SURFACE TREATMENT OR ROAD MIX LABORER; SIGN INSTALLER; SLURRY SEAL; UTILITY MAN; BRIDGE MAN; HANDYMAN; WATERPROOFING LABORER; FLAGPERSON; HAZARDOUS WASTE (LEVEL D); DIVER TENDER; ZONE PERSON & TRAFFIC CONTROL (REMAINING COUNTIES OF OHIO) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE

RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 35.52	14.45	
LABORER GROUP 1- ASPHALT LABORER; CARPENTER TENDER; CONCRETE CURING APPLICATOR; DUMP MAN (BATCH TRUCK); GUARDRAIL AND FENCE INSTALLER; JOINT SETTER; LABORER (CONSTRUCTION); LANDSCAPE LABORER; MESH HANDLERS & PLACER; RIGHT-OF-WAY LABORER; RIPRAP LABORER & GROUTER; SCAFFOLD ERECTOR; SEAL COATING; SURFACE TREATMENT OR ROAD MIX LABORER; SIGN INSTALLER; SLURRY SEAL; UTILITY MAN; BRIDGE MAN; HANDYMAN; WATERPROOFING LABORER; FLAGPERSON; HAZARDOUS WASTE (LEVEL D); DIVER TENDER; ZONE PERSON & TRAFFIC CONTROL (CUYAHOGA, GEAUGA & LAKE COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER		
CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 37.18	14.45	
LABORER GROUP 1- ASPHALT LABORER; CARPENTER TENDER; CONCRETE CURING APPLICATOR; DUMP MAN (BATCH TRUCK); GUARDRAIL AND FENCE INSTALLER; JOINT SETTER; LABORER (CONSTRUCTION); LANDSCAPE LABORER; MESH HANDLERS & PLACER; RIGHT-OF-WAY LABORER; RIPRAP LABORER & GROUTER; SCAFFOLD ERECTOR; SEAL COATING; SURFACE TREATMENT OR ROAD MIX LABORER; SIGN INSTALLER; SLURRY SEAL; UTILITY MAN; BRIDGE MAN; HANDYMAN; WATERPROOFING LABORER; FLAGPERSON; HAZARDOUS WASTE (LEVEL D); DIVER TENDER; ZONE PERSON & TRAFFIC CONTROL (ASHTABULA, ERIE, HURON, LORAIN, LUCAS, MAHONING, MEDINA, OTTAWA, PORTAGE, SANDUSKY, STARK, SUMMIT, TRUMBULL & WOOD COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 35.95		
LABORER GROUP 2- ASPHALT RAKER; CONCRETE PUDDLER; KETTLE MAN PIPELINE); MACHINE DRIVEN TOOLS (GAS, ELECTRIC, AIR); MASON TENDER; BRICK PAVER; MORTAR MIXER; POWER BUGGY OR POWER WHEELBARROW; PAINT STRIPER; SHEETING & SHORING MAN; SURFACE GRINDER MAN; PLASTIC FUSING MACHINE OPERATOR; PUG MILL OPERATOR; & VACUUM DEVICES (WET OR DRY); RODDING MACHINE OPERATOR; DIVER; SCREWMAN OR PAVER; SCREED PERSON; WATER BLAST, HAND HELD WAND; PUMPS 4" & UNDER (GAS, AIR OR ELECTRIC) & HAZARDOUS WASTE (LEVEL C); AIR TRACK AND WAGON DRILL; BOTTOM PERSON; COFFERDAM (BELOW 25 FT. DEEP); CONCRETE SAW PERSON; CUTTING WITH BURNING TORCH; FORM SETTER; HAND SPIKER (RAILROAD); PIPELAYER; TUNNEL LABORER (WITHOUT AIR) & CAISSON; UNDERGROUND PERSON (WORKING IN SEWER AND WATERLINE, CLEANING, REPAIRING & RECONDITIONING); SANDBLASTER NOZZLE PERSON; & HAZARDOUS WASTE (LEVEL B) (REMAINING COUNTIES OF OHIO) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 35.69	14.45	
LABORER GROUP 2- ASPHALT RAKER; CONCRETE PUDDLER; KETTLE MAN PIPELINE); MACHINE DRIVEN TOOLS (GAS, ELECTRIC, AIR); MASON TENDER; BRICK PAVER; MORTAR MIXER; POWER BUGGY OR POWER WHEELBARROW; PAINT STRIPER; SHEETING & SHORING MAN; SURFACE GRINDER MAN; PLASTIC FUSING MACHINE OPERATOR; PUG MILL OPERATOR; & VACUUM DEVICES (WET OR DRY); RODDING MACHINE OPERATOR; DIVER; SCREWMAN OR PAVER; SCREED PERSON; WATER BLAST, HAND HELD WAND; PUMPS 4" & UNDER (GAS, AIR OR ELECTRIC) & HAZARDOUS WASTE (LEVEL C); AIR TRACK AND WAGON DRILL; BOTTOM PERSON; COFFERDAM (BELOW 25 FT. DEEP); CONCRETE SAW PERSON; CUTTING WITH BURNING TORCH; FORM SETTER; HAND SPIKER (RAILROAD); PIPELAYER; TUNNEL LABORER (WITHOUT AIR) & CAISSON; UNDERGROUND PERSON (WORKING IN SEWER AND WATERLINE, CLEANING, REPAIRING & RECONDITIONING); SANDBLASTER NOZZLE PERSON; & HAZARDOUS WASTE (LEVEL B) (CUYAHOGA, GEAUGA & LAKE COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 37.35		14.45
LABORER GROUP 2- ASPHALT RAKER; CONCRETE PUDDLER;		

KETTLE MAN PIPELINE); MACHINE DRIVEN TOOLS (GAS, ELECTRIC, AIR); MASON TENDER; BRICK PAVER; MORTAR MIXER; POWER BUGGY OR POWER WHEELBARROW; PAINT STRIPER; SHEETING & SHORING MAN; SURFACE GRINDER MAN; PLASTIC FUSING MACHINE OPERATOR; PUG MILL OPERATOR; & VACUUM DEVICES (WET OR DRY); RODDING MACHINE OPERATOR; DIVER; SCREWMAN OR PAVER; SCREED PERSON; WATER BLAST, HAND HELD WAND; PUMPS 4" & UNDER (GAS, AIR OR ELECTRIC) & HAZARDOUS WASTE (LEVEL C); AIR TRACK AND WAGON DRILL; BOTTOM PERSON; COFFERDAM (BELOW 25 FT. DEEP); CONCRETE SAW PERSON; CUTTING WITH BURNING TORCH; FORM SETTER; HAND SPIKER (RAILROAD); PIPELAYER; TUNNEL LABORER (WITHOUT AIR) & CAISSON; UNDERGROUND PERSON (WORKING IN SEWER AND WATERLINE, CLEANING, REPAIRING & RECONDITIONING); SANDBLASTER NOZZLE PERSON; & HAZARDOUS WASTE (LEVEL B) (ASHTABULA, ERIE, HURON, LORAIN, LUCAS, MAHONING, MEDINA, OTTAWA, PORTAGE, SANDUSKY, STARK, SUMMIT, TRUMBULL & WOOD COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.\$ 36.12 14.45

LABORER GROUP 3- BLASTER; MUCKER; POWDER PERSON; TOP LANDER; WRENCHER (MECHANICAL JOINTS & UTILITY PIPELINE); YARNER; HAZARDOUS WASTE (LEVEL A); CONCRETE SPECIALIST; CONCRETE CREW IN TUNNELS (WITH AIR-PRESSURIZED - \$1.00 PREMIUM); CURB SETTER & CUTTER; GRADE CHECKER; UTILITY PIPELINE TAPPER; WATERLINE; AND CAULKER (REMAINING COUNTIES OF OHIO) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 36.02 14.45

LABORER GROUP 3- BLASTER; MUCKER; POWDER PERSON; TOP LANDER; WRENCHER (MECHANICAL JOINTS & UTILITY PIPELINE); YARNER; HAZARDOUS WASTE (LEVEL A); CONCRETE SPECIALIST; CONCRETE CREW IN TUNNELS (WITH AIR-PRESSURIZED - \$1.00 PREMIUM); CURB SETTER & CUTTER; GRADE CHECKER; UTILITY PIPELINE TAPPER; WATERLINE; AND CAULKER (CUYAHOGA, GEAUGA & LAKE COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 37.68 14.45

LABORER GROUP 3- BLASTER; MUCKER; POWDER PERSON; TOP LANDER; WRENCHER (MECHANICAL JOINTS & UTILITY PIPELINE); YARNER; HAZARDOUS WASTE (LEVEL A); CONCRETE SPECIALIST; CONCRETE CREW IN TUNNELS (WITH AIR-PRESSURIZED - \$1.00 PREMIUM); CURB SETTER & CUTTER; GRADE CHECKER; UTILITY PIPELINE TAPPER; WATERLINE; AND CAULKER (ASHTABULA, ERIE, HURON, LORAIN, LUCAS, MAHONING, MEDINA, OTTAWA, PORTAGE, SANDUSKY, STARK, SUMMIT, TRUMBULL & WOOD COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 36.45 14.45

LABORER GROUP 4- MINER (WITH AIR-PRESSURIZED - \$1.00 PREMIUM); & GUNITE NOZZLE PERSON (ASHTABULA, ERIE, HURON, LORAIN, LUCAS, MAHONING, MEDINA, OTTAWA, PORTAGE, SANDUSKY, STARK, SUMMIT, TRUMBULL & WOOD COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 36.90 14.45

LABORER GROUP 4- MINER (WITH AIR-PRESSURIZED - \$1.00 PREMIUM); & GUNITE NOZZLE PERSON (CUYAHOGA, GEAUGA & LAKE COUNTIES) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.....\$ 38.13 14.45

LABORER GROUP 4- MINER (WITH AIR-PRESSURIZED - \$1.00 PREMIUM); & GUNITE NOZZLE PERSON (REMAINING COUNTIES OF OHIO) TUNNEL LABORER WITH AIR-PRESSURIZED ADD \$1.00 TO BASE RATE SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS

SIGNALING.....	\$ 36.47	14.45
LABORER: SEWAGE PLANTS, WASTE PLANTS, WATER TREATMENT FACILITIES, PUMPING STATIONS, & ETHANOL PLANTS CONSTRUCTION (CUYAHOGA AND GEAUGA COUNTIES ONLY).....		
	\$ 38.56	14.45

PAIN0006-002 05/01/2023

	Rates	Fringes
PAINTER COMMERCIAL NEW WORK; REMODELING; & RENOVATIONS: GROUP 1- BRUSH; & ROLLER (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. OF THE EAST-WEST TURNPIKE) & SUMMIT (N. OF THE EAST-WEST TURNPIKE)).....	\$ 30.75	18.95
PAINTER COMMERCIAL NEW WORK; REMODELING; & RENOVATIONS: GROUP 2- SANDBLASTING & BUFFING (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. OF THE EAST-WEST TURNPIKE) & SUMMIT (N. OF THE EAST-WEST TURNPIKE)).....	\$ 31.15	18.95
PAINTER COMMERCIAL NEW WORK; REMODELING; & RENOVATIONS: GROUP 3- SPRAY PAINTING; CLOSED STEEL ABOVE 55 FEET; BRIDGES & OPEN STRUCTURAL STEEL; TANKS - WATER TOWERS; BRIDGE PAINTERS; BRIDGE RIGGERS; CONTAINMENT BUILDERS (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. OF THE EAST-WEST TURNPIKE) & SUMMIT (N. OF THE EAST-WEST TURNPIKE)).....	\$ 31.45	18.95
PAINTER COMMERCIAL NEW WORK; REMODELING; & RENOVATIONS: GROUP 4- BRIDGE BLASTER (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. OF THE EAST-WEST TURNPIKE) & SUMMIT (N. OF THE EAST-WEST TURNPIKE))	\$ 37.01	18.95
PAINTER COMMERCIAL REPAINT GROUP 1- BRUSH; & ROLLER (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. OF THE EAST-WEST TURNPIKE) & SUMMIT (N. OF THE EAST-WEST TURNPIKE)).....	\$ 29.25	18.95
PAINTER COMMERCIAL REPAINT GROUP 2- SANDBLASTING & BUFFING (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. OF THE EAST-WEST TURNPIKE) & SUMMIT (N. OF THE EAST-WEST TURNPIKE)).....	\$ 29.65	18.95
PAINTER COMMERCIAL REPAINT GROUP 3- SPRAY PAINTING..	\$ 29.95	18.95

PAIN0007-002 07/01/2025

	Rates	Fringes
PAINTER NEW COMMERCIAL WORK GROUP 1- BRUSH; SPRAY & SANDBLASTING POT TENDER. REPAINT IS 90% OF GROUP RATE.....	\$ 33.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 2- REFINERIES & REFINERY TANKS; SURFACES 30 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 3- SWING STAGE & CHAIR (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 4- LEAD ABATEMENT (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 5- ALL METHODS OF SPRAY (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 6- SOLVENT-BASED CATALYZED EPOXY MATERIALS OF 2 OR MORE COMPONENT MATERIALS, TO INCLUDE SOLVENT-BASED CONVERSION VARNISH (EXCLUDING WATER BASED) (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE,		

DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 7- SPRAY SOLVENT BASED MATERIAL; SAND & ABRASIVE BLASTING (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....		
	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 8- TOWERS; TANKS; BRIDGES; STACKS OVER 30 FEET (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....		
	\$ 34.66	23.88
PAINTER: NEW COMMERCIAL WORK: GROUP 9- EPOXY SPRAY (EXCLUDING WATER BASED) (FULTON, HENRY, LUCAS, OTTAWA (EXCLUDING ALLEN, BAY, BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE, DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE, FISHBACK, GEM BEACH & GENOVA) & WOOD) REPAINT IS 90% OF GROUP RATE.....		
	\$ 34.66	23.88

PAIN0012-008 05/01/2019

	Rates	Fringes
PAINTER: GROUP 1- BRIDGE EQUIPMENT TENDER; BRIDGE/CONTAINMENT BUILDER (BUTLER COUNTY).....	\$ 21.95	10.20
PAINTER: GROUP 2- BRUSH & ROLLER (BUTLER COUNTY)....	\$ 25.30	10.20
PAINTER: GROUP 3- SPRAY (BUTLER COUNTY).....	\$ 25.80	10.20
PAINTER: GROUP 4- SANDBLASTING; & WATERBLASTING (BUTLER COUNTY).....	\$ 26.05	10.20
PAINTER: GROUP 5- ELEVATED TANKS; STEEPLEJACK WORK; BRIDGE; & LEAD ABATEMENT (BUTLER COUNTY).....	\$ 26.30	10.20

PAIN0012-010 05/01/2019

	Rates	Fringes
PAINTER HEAVY & HIGHWAY BRIDGES- GUARDRAILS-LIGHTPOLES- STRIPING BRIDGE EQUIPMENT TENDER AND CONTAINMENT BUILDER (BROWN, CLERMONT, HAMILTON & WARREN).....	\$ 21.95	10.20
PAINTER HEAVY & HIGHWAY BRIDGES- GUARDRAILS-LIGHTPOLES- STRIPING BRIDGES WHEN HIGHEST POINT OF CLEARANCE IS 60 FEET OR MORE; & LEAD ABATEMENT PROJECTS (BROWN, CLERMONT, HAMILTON & WARREN).....	\$ 26.30	10.20
PAINTER HEAVY & HIGHWAY BRIDGES- GUARDRAILS-LIGHTPOLES- STRIPING BRUSH & ROLLER (BROWN, CLERMONT, HAMILTON & WARREN).....	\$ 25.30	10.20
PAINTER HEAVY & HIGHWAY BRIDGES- GUARDRAILS-LIGHTPOLES- STRIPING SANDBLASTING & HOPPER TENDER; WATER BLASTING (BROWN, CLERMONT, HAMILTON & WARREN).....	\$ 26.05	10.20
PAINTER HEAVY & HIGHWAY BRIDGES- GUARDRAILS-LIGHTPOLES- STRIPING SPRAY (BROWN, CLERMONT, HAMILTON & WARREN).....	\$ 25.80	10.20

PAIN0093-001 12/01/2024

	Rates	Fringes
PAINTER: BRIDGES; LOCKS; DAMS; TENSION TOWERS; & ENERGIZED SUBSTATIONS (ATHENS, GUERNSEY, HOCKING, MONROE, MORGAN, NOBLE AND WASHINGTON COUNTIES).....	\$ 36.44	24.46
PAINTER: POWER GENERATING FACILITIES (ATHENS, GUERNSEY, HOCKING, MONROE, MORGAN, NOBLE AND WASHINGTON COUNTIES).....	\$ 33.29	24.46

PAIN0249-002 05/01/2025

	Rates	Fringes
PAINTER: GROUP 1: BRUSH & ROLLER (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 29.15	13.97
PAINTER: GROUP 2: SWING, SCAFFOLD BRIDGES; STRUCTURAL STEEL; OPEN ACID TANK; HIGH TENSION ELECTRICAL EQUIPMENT; & HOT PIPES (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 33.09	13.97
PAINTER: GROUP 3: SPRAY; SANDBLAST; STEAMCLEAN; LEAD ABATEMENT (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 29.90	13.97

PAINTER: GROUP 4: STEEPLEJACK WORK (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 30.10	13.97
PAINTER: GROUP 5: COAL TAR (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 30.65	13.97
PAINTER: GROUP 6: BRIDGE EQUIPMENT TENDER & OR CONTAINMENT BUILDER (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 37.86	13.97
PAINTER: GROUP 7: TANKS, STACKS & TOWERS (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE)..	\$ 33.86	13.97
PAINTER: GROUP 8: BRIDGE BLASTER, RIGGER (CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE)..	\$ 40.86	13.97

PAIN0356-002 09/01/2009

	Rates	Fringes
PAINTER: BRIDGE EQUIPMENT TENDERS AND CONTAINMENT BUILDERS (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 27.93	7.25
PAINTER: BRIDGES; BLASTERS; AND RIGGERS (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 34.60	7.25
PAINTER: BRUSH AND ROLLER (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 20.93	7.25
PAINTER: SANDBLASTING; STEAM CLEANING; WATERBLASTING; AND HAZARDOUS WORK (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 25.82	7.25
PAINTER: SPRAY (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 21.40	7.25
PAINTER: STRUCTURAL STEEL AND SWING STAGE (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 25.42	7.25
PAINTER: TANKS; STACKS; AND TOWERS (KNOX, LICKING, MUSKINGUM, AND PERRY).....	\$ 28.63	7.25

PAIN0438-002 12/01/2023

	Rates	Fringes
PAINTER: BRIDGES, LOCKS, DAMS, TENSION TOWERS & ENERGIZED SUBSTATIONS (BELMONT, HARRISON AND JEFFERSON COUNTIES).....	\$ 36.09	19.49
PAINTER: POWER GENERATING FACILITIES (BELMONT, HARRISON AND JEFFERSON COUNTIES).....	\$ 32.94	19.49

PAIN0476-001 06/01/2025

	Rates	Fringes
PAINTER: GROUP 1- PAINTERS, BRUSH & ROLLER (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 30.64	18.36
PAINTER: GROUP 2- BRIDGES (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 40.27	18.36
PAINTER: GROUP 3- STRUCTURAL STEEL (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 40.27	18.36
PAINTER: GROUP 4- SPRAY, EXCEPT BAR JOIST/DECK (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 31.14	18.36
PAINTER: GROUP 5- EPOXY/MASTIC; SPRAY- BAR JOIST/DECK; WORKING ABOVE 50 FEET; AND SWINGSTAGES (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 31.29	18.36
PAINTER: GROUP 6- TANKS; SANDBLASTING (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 35.27	18.36
PAINTER: GROUP 7- TOWERS; STACKS (COLUMBIANA, MAHONING, AND TRUMBULL COUNITIES).....	\$ 32.64	18.36

PAIN0555-002 01/01/2025

	Rates	Fringes
PAINTER: GROUP 1- CONTAINMENT BUILDER (ADAMS, HIGHLAND, JACKSON, PIKE & SCIOTO).....	\$ 33.32	21.54
PAINTER: GROUP 2- BRUSH; ROLLER; POWER TOOLS, UNDER 40 FEET (ADAMS, HIGHLAND, JACKSON, PIKE & SCIOTO)..	\$ 35.02	21.54
PAINTER: GROUP 3- SAND BLASTING; SPRAY; STEAM CLEANING; PRESSURE WASHING; EPOXY & TWO COMPONENT MATERIALS; LEAD ABATEMENT; HAZARDOUS WASTE; TOXIC MATERIALS; BULK & STORAGE TANKS OF 25,000 GALLON CAPACITY OR MORE; ELEVATED TANKS (ADAMS, HIGHLAND, JACKSON, PIKE & SCIOTO).....	\$ 36.72	21.54
PAINTER: GROUP 4- STACKS; BRIDGES (ADAMS, HIGHLAND, JACKSON, PIKE & SCIOTO).....	\$ 40.03	21.54

PAIN0639-001 05/01/2011

	Rates	Fringes
SIGN PAINTER & ERECTOR FOOTNOTES: A. 7 PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; JULY 4TH; LABOR DAY; THANKSGIVING DAY; CHRISTMAS DAY & 1		

FLOATING DAY B. VACATION PAY: AFTER 1 YEAR'S
 SERVICE - 5 DAYS' PAID VACATION; AFTER 2, BUT LESS
 THAN 10 YEARS' SERVICE - 10 DAYS' PAID VACATION;
 AFTER 10, BUT LESS THAN 20 YEARS' SERVICE - 15
 DAYS' PAID VACATION; AFTER 20 YEARS' SERVICE - 20
 DAYS' PAID VACATION C. FUNERAL LEAVE UP TO 3 DAYS
 MAXIMUM PAID LEAVE FOR DEATH OF MOTHER, FATHER,
 BROTHER, SISTER, SPOUSE, CHILD, MOTHER-IN-LAW,
 FATHER-IN-LAW, GRANDPARENT AND INLAW PROVIDED
 EMPLOYEE ATTENDS FUNERAL.....\$ 20.61 3.50

PAIN0788-002 06/01/2024

Rates

Fringes

PAINTER: BRUSH & ROLLER (ASHLAND, CRAWFORD, ERIE,
 HANCOCK, HURON, MARION, MORROW, OTTAWA (ALLEN, BAY,
 BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE,
 DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE,
 FISHBACK, GEM BEACH & GENOA), RICHLAND, SANDUSKY,
 SENECA & WYANDOT) WINTER REPAINT: BETWEEN
 DECEMBER 1 TO MARCH 31 - 90%JR \$.50 PER HOUR
 SHALL BE ADDED TO THE RATE OF PAY FOR THE
 CLASSIFICATION OF WORK: WHILE WORKING
 SWINGSTAGE, BOATSWAIN CHAIR, NEEDLE BEAM AND
 HORIZONTAL CABLE. WHILE OPERATING SPRAYGUNS,
 SANDBLASTING, COBBLASTING AND HIGH PRESSURE
 WATERBLASTING (4000PSI). \$1.00 PER HOUR SHALL
 BE ADDED TO THE RATE OF PAY FOR THE CLASSIFICATION
 OF WORK: FOR THE APPLICATION OF CATALIZED
 EPOXY, INCLUDING LATEX EPOXY THAT IS DEEMED
 HAZARDOUS, LEAD ABATEMENT, OR FOR WORK OR MATERIAL
 WHERE SPECIAL PRECAUTIONS BEYOND NORMAL WORK DUTIES
 MUST BE TAKEN. FOR WORKING ON STACKS, TANKS, AND
 TOWERS OVER 40 FEET IN HEIGHT.....\$ 29.13 17.52

PAINTER: STRUCTURAL STEEL (ASHLAND, CRAWFORD, ERIE,
 HANCOCK, HURON, MARION, MORROW, OTTAWA (ALLEN, BAY,
 BONO, CATAWBA ISLAND, CLAY CENTER, CURTICE,
 DANBURY, EAGLE BEACH, ELLISTON, ELMORE, ERIE,
 FISHBACK, GEM BEACH & GENOA), RICHLAND, SANDUSKY,
 SENECA & WYANDOT) WINTER REPAINT: BETWEEN
 DECEMBER 1 TO MARCH 31 - 90%JR \$.50 PER HOUR
 SHALL BE ADDED TO THE RATE OF PAY FOR THE
 CLASSIFICATION OF WORK: WHILE WORKING
 SWINGSTAGE, BOATSWAIN CHAIR, NEEDLE BEAM AND
 HORIZONTAL CABLE. WHILE OPERATING SPRAYGUNS,
 SANDBLASTING, COBBLASTING AND HIGH PRESSURE
 WATERBLASTING (4000PSI). \$1.00 PER HOUR SHALL
 BE ADDED TO THE RATE OF PAY FOR THE CLASSIFICATION
 OF WORK: FOR THE APPLICATION OF CATALIZED
 EPOXY, INCLUDING LATEX EPOXY THAT IS DEEMED
 HAZARDOUS, LEAD ABATEMENT, OR FOR WORK OR MATERIAL
 WHERE SPECIAL PRECAUTIONS BEYOND NORMAL WORK DUTIES
 MUST BE TAKEN. FOR WORKING ON STACKS, TANKS, AND
 TOWERS OVER 40 FEET IN HEIGHT.....\$ 30.73 17.52

PAIN0813-005 12/01/2008

Rates

Fringes

PAINTER: BASE RATE (GALLIA, LAWRENCE, MEIGS &
 VINTON).....\$ 24.83 10.00

PAINTER: BRIDGES, LOCKS, DAMS & TENSION TOWERS
 (GALLIA, LAWRENCE, MEIGS & VINTON).....\$ 27.83 10.00

PAIN0841-001 07/01/2025

Rates

Fringes

PAINTERS: GROUP 1- BRUSH, ROLLER & PAPERHANGER
 (MEDINA, PORTAGE (SOUTH OF AND INCLUDING OHIO
 TURNPIKE), AND SUMMIT (SOUTH OF AND INCLUDING OHIO
 TURNPIKE) COUNTIES).....\$ 31.93 18.15

PAINTERS: GROUP 2- EPOXY APPLICATION (MEDINA,
 PORTAGE (SOUTH OF AND INCLUDING OHIO TURNPIKE), AND
 SUMMIT (SOUTH OF AND INCLUDING OHIO TURNPIKE)
 COUNTIES).....\$ 32.58 18.15

PAINTERS: GROUP 3- SWING SCAFFOLD, BOSUM CHAIR, &
 WINDOW JACK (MEDINA, PORTAGE (SOUTH OF AND
 INCLUDING OHIO TURNPIKE), AND SUMMIT (SOUTH OF AND
 INCLUDING OHIO TURNPIKE) COUNTIES).....\$ 32.68 18.15

PAINTERS: GROUP 4- SPRAY GUN OPERATOR OF ANY & ALL
 COATINGS (MEDINA, PORTAGE (SOUTH OF AND INCLUDING
 OHIO TURNPIKE), AND SUMMIT (SOUTH OF AND INCLUDING

OHIO TURNPIKE) COUNTIES).....\$ 32.78	18.15
PAINTERS: GROUP 5- SANDBLAST, PAINTING OF STANDPIPES, ETC. FROM SCAFFOLDS, BRIDGE WORK AND/OR OPEN STRUCTURAL STEEL, STANDPIPES AND/OR WATER TOWERS (MEDINA, PORTAGE (SOUTH OF AND INCLUDING OHIO TURNPIKE), AND SUMMIT (SOUTH OF AND INCLUDING OHIO TURNPIKE) COUNTIES).....\$ 33.18	18.15
PAINTERS: GROUP 6- PUBLIC & COMMERCE TRANSPORTATION, STEEL OR GALVANIZED, BRIDGES, TUNNELS & RELATED SUPPORT ITEMS (CONCRETE) (MEDINA, PORTAGE (SOUTH OF AND INCLUDING OHIO TURNPIKE), AND SUMMIT (SOUTH OF AND INCLUDING OHIO TURNPIKE) COUNTIES).....\$ 38.60	18.15
PAINTERS: GROUP 7- SYNTHETIC EXTERIOR, DRYWALL FINISHER AND/OR TAPER, DRYWALL FINISHER AND FOLLOW-UP MAN USING AUTOMATIC TOOLS (MEDINA, PORTAGE (SOUTH OF AND INCLUDING OHIO TURNPIKE), AND SUMMIT (SOUTH OF AND INCLUDING OHIO TURNPIKE) COUNTIES).....\$ 33.18	18.15

PAIN0841-002 07/01/2025

Rates	Fringes
PAINTER: BRIDGES; TOWERS, POLES & STACKS; SANDBLASTING STEEL; STRUCTURAL STEEL & METALIZING (CARROLL, COSHOCTON, HOLMES, STARK, TUSCARAWAS & WAYNE).....\$ 33.18	18.15
PAINTER: BRUSH & ROLLER (CARROLL, COSHOCTON, HOLMES, STARK, TUSCARAWAS & WAYNE).....\$ 31.93	18.15
PAINTER: SPRAY; TANK INTERIOR & EXTERIOR (CARROLL, COSHOCTON, HOLMES, STARK, TUSCARAWAS & WAYNE).....\$ 32.78	18.15

PAIN1020-002 07/01/2025

Rates	Fringes
PAINTER: BRUSH & ROLLER (ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, AND WILLIAMS COUNTIES) ALL SURFACES 40 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON, ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) - \$.50 PREMIUM APPLYING COAL TAR PRODUCTS - \$1.00 PREMIUM.....\$ 27.59	18.54
PAINTER: DRYWALL FINISHING & TAPING (ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, AND WILLIAMS COUNTIES): LL SURFACES 40 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON, ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) - \$.50 PREMIUM APPLYING COAL TAR PRODUCTS - \$1.00 PREMIUM.....\$ 28.34	18.54
PAINTER: LEAD ABATEMENT (ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, AND WILLIAMS COUNTIES) ALL SURFACES 40 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON, ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) - \$.50 PREMIUM APPLYING COAL TAR PRODUCTS - \$1.00 PREMIUM.....\$ 29.34	18.54
PAINTER: SPRAY, SANDBLASTING PRESSURE CLEANING, & REFINERY (ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, AND WILLIAMS COUNTIES) ALL SURFACES 40 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON, ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) - \$.50 PREMIUM APPLYING COAL TAR PRODUCTS - \$1.00 PREMIUM.....\$ 28.34	18.54
PAINTER: SWING STAGE, CHAIR, SPIDERS, & CHERRY PICKERS (ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, AND WILLIAMS COUNTIES) ALL SURFACES 40 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON, ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) - \$.50 PREMIUM APPLYING COAL TAR PRODUCTS - \$1.00 PREMIUM.....\$ 27.84	18.54
PAINTER: WALLCOVERINGS (ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, AND WILLIAMS COUNTIES) ALL SURFACES 40 FT. OR OVER WHERE MATERIAL IS APPLIED TO OR LABOR PERFORMED ON, ABOVE GROUND LEVEL (EXTERIOR), FLOOR LEVEL (INTERIOR) - \$.50 PREMIUM	

APPLYING COAL TAR PRODUCTS - \$1.00 PREMIUM.....	\$ 28.34	18.54

PAIN1275-002 05/01/2025		
	Rates	Fringes
PAINTER: BRIDGES (DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION).....	\$ 37.26	15.16
PAINTER: BRUSH; ROLLER (DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION).....	\$ 30.20	15.16
PAINTER: SANDBLASTING; STEAMCLEANING; WATERBLASTING (3500 PSI OR OVER)& HAZARDOUS WORK (DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION).....	\$ 32.35	15.16
PAINTER: SPRAY (DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION).....	\$ 32.15	15.16
PAINTER: STACKS; TANKS; & TOWERS (DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION).....	\$ 34.46	15.16
PAINTER: STRUCTURAL STEEL & SWING STAGE (DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION).....	\$ 30.50	15.16

PLAS0109-001 06/01/2025		
	Rates	Fringes
PLASTERER (MEDINA, PORTAGE, STARK, AND SUMMIT COUNTIES).....	\$ 33.00	23.83

PLAS0109-003 06/01/2025		
	Rates	Fringes
PLASTERER (CARROLL, HOLMES, TUSCARAWAS, AND WAYNE COUNTIES).....	\$ 33.00	23.83

PLAS0132-002 07/01/2025		
	Rates	Fringes
PLASTERER (BROWN, BUTLER, CLERMONT, HAMILTON, HIGHLAND, WARREN COUNTIES).....	\$ 31.35	17.65

PLAS0404-002 05/01/2018		
	Rates	Fringes
PLASTERER (ASHTABULA, CUYAHOGA, GEAUGA, AND LAKE COUNTIES).....	\$ 29.63	17.11

PLAS0404-003 05/01/2018		
	Rates	Fringes
PLASTERER (LORAIN COUNTY).....	\$ 28.86	17.11

PLAS0526-022 05/01/2018		
	Rates	Fringes
PLASTERER (COLUMBIANA, MAHONING, AND TRUMBULL COUNTIES).....	\$ 28.86	17.11

PLAS0526-023 05/01/2018		
	Rates	Fringes
PLASTERER (BELMONT, HARRISON, AND JEFFERSON COUNTIES).....	\$ 28.21	17.11

PLAS0886-001 07/01/2025		
	Rates	Fringes
PLASTERER (FULTON, HANCOCK, HENRY, LUCAS, PUTNAM, AND WOOD COUNTIES).....	\$ 36.65	25.60

PLAS0886-003 07/01/2025		
	Rates	Fringes
PLASTERER (DEFIANCE, ERIE, HURON, OTTAWA, PAULDING, SANDUSKY, AND SENECA).....	\$ 36.65	25.60

PLAS0886-004 07/01/2025		
	Rates	Fringes
PLASTERER (ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, AND VAN WERT).....	\$ 35.29	23.07

PLUM0042-002 07/01/2025		
	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER (ASHLAND, CRAWFORD, ERIE, HURON, KNOX, LORAIN, MORROW, RICHLAND & WYANDOT).....	\$ 43.02	26.45
PLUM0050-002 06/30/2025		
	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER (DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD).....	\$ 51.00	32.56
PLUM0055-003 05/05/2025		
	Rates	Fringes
PLUMBER (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, MEDINA (N. OF RTE. #18 & SMITH ROAD) & SUMMIT (N. OF RTE. #303, INCLUDING THE CORPORATE LIMITS OF THE CITY OF HUDSON)).....	\$ 44.86	30.03
PLUM0083-001 07/01/2023		
	Rates	Fringes
PLUMBER AND STEAMFITTER (BELMONT & MONROE (NORTH OF RTE. #78)).....	\$ 35.94	37.35
PLUM0094-002 05/01/2025		
	Rates	Fringes
PLUMBER/PIPEFITTER (CARROLL (NORTHERN HALF), STARK, AND WAYNE COUNTIES).....	\$ 47.48	27.14
PLUM0120-002 05/01/2025		
	Rates	Fringes
PIPEFITTER (ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN (THE C.E.I. POWER HOUSE IN AVON LAKE), MEDINA (N. OF RTE. #18) & SUMMIT (N. OF #303)).....	\$ 49.17	28.55
PLUM0162-002 06/01/2024		
	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER (CHAMPAIGN, CLARK, CLINTON, DARKE, FAYETTE, GREENE, MIAMI, MONTGOMERY & PREBLE).....	\$ 43.05	27.18
PLUM0168-002 06/01/2025		
	Rates	Fringes
PLUMBER/PIPEFITTER (MEIGS, MONROE (SOUTH OF RTE. #78), MORGAN (SOUTH OF RTE. #78) & WASHINGTON).....	\$ 40.92	37.20
PLUM0189-002 06/01/2025		
	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER (DELAWARE, FAIRFIELD, FRANKLIN, HOCKING, LICKING, MADISON, MARION, PERRY, PICKAWAY, ROSS & UNION).....	\$ 53.00	27.59
PLUM0219-002 06/01/2025		
	Rates	Fringes
PLUMBER AND STEAMFITTER (MEDINA (RTE. #18 FROM EASTERN EDGE OF MEDINA CO., WEST TO EASTERN CORPORATE LIMITS OF THE CITY OF MEDINA, & ON THE COUNTY ROAD FROM THE WEST CORPORATE LIMITS OF MEDINA RUNNING DUE WEST TO AND THROUGH COMMUNITY OF RISLEY TO THE WESTERN EDGE OF MEDINA COUNTY - ALL TERRITORY SOUTH OF THIS LINE), PORTAGE, AND SUMMIT (S. OF RTE. #303) COUNTIES).....	\$ 46.87	28.39
PLUM0392-002 06/01/2025		
	Rates	Fringes
PLUMBER/PIPEFITTER (BROWN, BUTLER, CLERMONT, HAMILTON & WARREN).....	\$ 43.30	27.40

PLUM0396-001 06/01/2025

Rates

Fringes

PLUMBER/PIPEFITTER (COLUMBIANA (EXCLUDING WASHINGTON & YELLOW CREEK TOWNSHIPS & LIVERPOOL TWP. - SECS. 35 & 36 - WEST OF COUNTY ROAD #427), MAHONING AND TRUMBULL COUNTIES).....\$ 40.55 29.25

PLUM0495-002 06/01/2025

Rates

Fringes

PLUMBER, PIPEFITTER, STEAMFITTER (CARROLL (ROSE, MONROE, UNION, LEE, ORANGE, PERRY & LOUDON TOWNSHIPS), COLUMBIANA (WASHINGTON & YELLOW CREEK TOWNSHIPS & LIVERPOOL TOWNSHIP, SECS. 35 & 36, WEST OF COUNTY RD. #427), COSHOCTON, GUERNSEY, HARRISON, HOLMES, JEFFERSON, MORGAN (SOUTH TO STATE RTE. #78 & FROM MCCONNELLSVILLE WEST ON STATE RTE. #37 TO THE PERRY COUNTY LINE), MUSKINGUM, NOBLE, AND TUSCARAWAS COUNTIES).....\$ 39.32 37.60

PLUM0577-002 06/01/2025

Rates

Fringes

PLUMBER, PIPEFITTER, STEAMFITTER (ADAMS, ATHENS, GALLIA, HIGHLAND, JACKSON, LAWRENCE, PIKE, SCIOTO & VINTON).....\$ 42.65 28.56

PLUM0776-002 07/01/2025

Rates

Fringes

PLUMBER, PIPEFITTER, STEAMFITTER (ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, SHELBY AND VAN WERT COUNTIES).....\$ 42.76 30.81

TEAM0377-003 05/01/2025

Rates

Fringes

TRUCK DRIVER: GROUP 1- ASPHALT DISTRIBUTOR; BATCH; 4- WHEEL SERVICE; 4-WHEEL DUMP; OIL DISTRIBUTOR & TANDEM (STATEWIDE, EXCEPT CUYAHOGA, GEAUGA & LAKE).....\$ 34.26 18.85
TRUCK DRIVER: GROUP 2- TRACTOR-TRAILER COMBINATION: FUEL; POLE TRAILER; READY MIX; SEMI-TRACTOR; & ASPHALT OIL SPRAYBAR MAN WHEN OPERATED FROM CAB; 5 AXLES & OVER; BELLY DUMP; END DUMP; ARTICULATED DUMP; HEAVY DUTY EQUIPMENT; LOW BOY; & TRUCK MECHANIC (STATEWIDE, EXCEPT CUYAHOGA, GEAUGA & LAKE).....\$ 35.26 18.85

TEAM0436-002 05/01/2025

Rates

Fringes

TRUCK DRIVER: GROUP 1- STRAIGHT & DUMP, STRAIGHT FUEL (CUYAHOGA, GEAUGA & LAKE).....\$ 34.92 19.30
TRUCK DRIVER: GROUP 2- SEMI FUEL, SEMI TRACTOR, EUCLIDS, DARTS, TANK, ASPHALT SPREADERS, LOW BOYS, CARRY-ALL, TOURNA-ROCKERS, HI-LIFTS, EXTRA LONG TRAILERS, SEMI-POLE TRAILERS, DOUBLE HOOK-UP TRACTOR TRAILERS INCLUDING TEAM TRACK & RAILROAD SIDING, SEMI-TRACTOR & TRI-AXLE TRAILER, TANDEM TRACTOR & TANDEM TRAILER, TAG ALONG TRAILER, EXPANDABLE TRAILER OR TOWING REQUIRING ROAD PERMITS, READY-MIX (AGITATOR OR NON-AGITATOR), BULK CONCRETE DRIVER, DRY BATCH TRUCK, ARTICULATED END DUMP (CUYAHOGA, GEAUGA & LAKE).....\$ 35.73 19.30

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including

preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than "SU", "UAVG", "SA", or "SC" denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The "SU" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this

classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The "SA" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"