Jones & Henry
ENGINEERS, LTD.

INVITATION FOR BID NO. 836-8207.001
Paw Paw Lake Area Wastewater Treatment Plant
West Clarifier Improvements

ADDENDUM 001

June 9, 2025

Planholders on the Paw Paw Lake Area Wastewater Treatment Plant, West Clarifier Improvements Project are hereby notified of the following amendments to the Contract Documents. This Addendum is hereby made a part of the Contract Documents.

REFERENCE NOTES

- The pre-bid meeting date has officially been rescheduled to Tuesday, June 17th, 2025 at 10:00am.
- Approved lining coating manufacturers now includes SpectraShield and Quadex.
- Approved Electric Valve Operator product producers now includes Rotork.

SPECIFICATIONS

Replace the following specifications with the attached:

- C-111 – Advertisement for Bid
  - Updates pre-bid meeting date to June 17th, 2025 at 10:00am.
- 09960 – Corrosion and Infiltration Protection Coating
  - Updates acceptable manufacturer's list.
- 15210 – Piping
  - Removes specifications for pipe not included in the project's scope.
- 15211 – Small Piping and Valves
  - Updates acceptable electric valve operator product list.

Plan holders should update the Table of Contents to reflect the above sections.

An updated Table of Contents will be included in the Issued for Construction Project Manual.

RECEIPT OF THIS ADDENDUM MUST BE ACKNOWLEDGED ON PAGE 8 OF 33 OF THE INVITATION FOR BIDS AND INCLUDED WITH THE CONTRACTOR'S BID.

4791 Campus Drive, Kalamazoo, Michigan 49008 - 269.353.9650

PAW PAW LAKE AREA WASTEWATER PLANT
COLOMA, MICHIGAN
WEST CLARIFIER IMPROVEMENTS

ADVERTISEMENT FOR BIDS

Sealed Bids for 2025 West Clarifier Improvements project will be received by the Paw Paw Lake Area Joint Board, at the Wastewater Treatment Plant, at 4689 Defield Rd, Coloma, MI until 2:00 pm, local time, on June 26, 2025, at which time they will be publicly opened and read.

The West Primary Clarifier Improvements Bid Work shall generally consist of the following:

> *Removal of the existing west primary clarifier mechanism. Installation of a new west primary clarifier mechanism inside the existing western primary clarifier at the WWTP. Lining of the western primary clarifier. Lining of the western flow channel used to bring flow to the west primary clarifier. Lining of the flow balancing manholes located downstream of both primary clarifiers. Various piping and valve improvements inside of the flow balancing manholes. Various electrical improvements to accommodate the new mechanism and valves.*

The issuing office is Jones & Henry Engineers, Ltd. 4791 Campus Drive, Kalamazoo, MI 49008, 269-353-9650.

Technical questions regarding the project should be e-mailed to the Project Engineer Ethan Fisher, EFisher@jheng.com at Jones & Henry Engineers, Ltd.

Copies of Bidding Documents and Contract Documents may be obtained electronically from www.jhplanroom.com. There is no charge to download from the digital print-room, however, registration is required. If hard copies of the bidding documents are needed, they can be ordered from the print-room for a fee. If you have any problems using the digital print-room, you are encouraged to contact either the Engineer's Project Manager, or Eastern Engineering at 419-661-9841.

A pre-bid conference will be held at 10:00 am local time on June 17th **(Addendum 001, Issued: 06-09-2025)** at the Paw Paw Lake Area WWTP. Attendance at the pre-bid conference is highly encouraged but is not mandatory.

Neither Owner nor Engineer has any responsibility for the accuracy, completeness or sufficiency of any bid documents obtained from any source other than the source indicated in these documents. Obtaining these documents from any other source(s) may result in obtaining incomplete and inaccurate information. Obtaining these documents from any source other than directly from the source listed herein may also result in failure to receive any addenda, corrections, or other revisions to these documents that may be issued.

Bids must be submitted on the forms bound herein, must contain the names of every person or company interested therein, and shall be accompanied by a Bid Bond in the amount of 5% of the amount bid with satisfactory corporate surety, subject to conditions provided in the Instructions to Bidders. The successful bidder will be required to furnish satisfactory Performance Bond and Maintenance and Guarantee Bond in the amount of 100% of the Bid, and Labor and Material Bond in the amount of 50% of the Bid.

Any Bid may be withdrawn prior to the scheduled closing time for receipt of Bids, but no bidder shall withdraw his Bid within 60 days after the actual opening thereof.

The Owner reserves the right to reject any or all Bids, waive irregularities in any Bid, and to accept any Bid which is deemed most favorable to the Owner. The project is being funded, in part, through the issuance of municipal bonds and award of a contract to the selected bidder is contingent upon the successful sale of such bonds.

5-28-2025

Lonnie Bennett – WWTP Superintendent

Dated: May 28, 2025

SECTION 09960
CORROSION AND INFILTRATION PROTECTION COATING

PART 1 GENERAL

1.01 SCOPE

A. This section covers work, materials and equipment required to install a monolithic multi-layer/component concrete manhole/wetwell lining system to provide infiltration and corrosion protection.

B. This section includes procedures for surface preparation, cleaning, application and testing.

1.02 SUBMITTALS

A. Submit technical data sheets on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

B. Material Safety Data Sheets (MSDS) for each product used.

C. Submit technical data sheets and project specific data for repair materials to be top coated with the coating products including application, cure time and surface preparation.

D. Provide samples of the cured system including stepped samples showing stages of multi-layer/component applications.

E. Applicator Qualifications:

1. Manufacturer and Contractor specializing in the performance of work specified in this section with a minimum of three (3) years documented experience and 3,000 vertical feet of application.

2. Five (5) references of municipal sanitary sewer projects successfully performed within the past three years for projects similar in size and scope.

1.03 QUALITY ASSURANCE

A. Coating material shall be produced in an ISO 9001 certified facility.

B. Furnish materials of quality required by ASTM standards or other approved standards and specification.

C. Coating products shall be capable of being installed and curing properly within the specified environments. Coating products shall be resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems and capable of adhering to the substrates and repair products.

D. Coating products must have been tested by and passed ASTM G210-13 Severe Wastewater Analysis Testing (SWAT).

E. Repair product(s) shall be fully compatible with coating product(s) including ability to bond effectively to the host substrate and coating product(s) forming a composite system.

F. Contractor shall utilize equipment for the spray application of the coating product(s) which has been approved by the coating product manufacturer; and, Contractor shall have received training on the operation and maintenance of said equipment from the coating product manufacturer.

G. Contractor shall be trained by, or have their training approved and certified by, the coating product manufacturer for the handling, mixing, application and inspection of the coating product(s) to be used as specified herein.

H. Contractor shall be trained in the use of testing or inspection instrumentation and knowledgeable of the proper use, preparation and installation of the coating products to be used as specified herein.

I. Provide guarantee against defective materials and workmanship in accordance with the requirements of these specifications.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling: Prevent moisture damage and contamination of materials during delivery and handling.

B. Storage: Store materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1. Liquid products shall be protected from freezing while being stored.

1.05 DEFINITIONS:

A. Cleaning: Removal of sand, dirt, roots, grease and all other solid or semi-solid material from the structures as required for proper application of patching and coating products.

B. Faults: Leaking joints, cracks, breaks or other imperfections in the structure.

1.06 JOB CONDITIONS

A. Environmental Requirements:

1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the Manufacturer. Do not apply the products of this Section to frozen surfaces.

2. Do not apply coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the Manufacturer.

B. Protection:

1. Public Safety: If public safety is endangered during the progress of the rehabilitation work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.

a. Signs, signals and barricades used shall conform to requirements of Federal, State and Local laws, rules, regulations, precautions, orders, and decrees.

2. Existing Facilities Protection: Protect existing structures from damage due to operations associated with work of this Section.

3. Personnel Protection: It is the responsibility of the Contractor to provide appropriate protective measures to ensure that chemicals are under the control of the Contractor at all times and are not available to unauthorized personnel or animals.

1.07 WARRANTY

A. Manufacturer and Applicator warrant the liner system against failure for a period of 10 years. "Failure" will be deemed to have occurred if the protective lining fails to prevent the internal deterioration or corrosion of the structure or prevent groundwater

infiltration. If any such failure occurs within 10 years of initial completion of work on a structure, the damage will be repaired at no cost to the Owner. "Failure" does not include damage resulting from mechanical or chemical abuse or act of God. Mechanical or chemical abuse means exposing the lined surfaces of the structure to any mechanical force or chemical substance not customarily present.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers that may be used include:

1. OBIC, LLC.
2. SpectraShield **(Addendum 001, Issued on 06-09-2025)**
3. Quadex **(Addendum 001, Issued on 06-09-2025)**

2.02 PROTECTIVE LINING SYSTEM MATERIALS

A. The protective lining system shall be a multi-layer/component protective lining system, including:

1. Polyurea Adhesion Coating
2. Polymer Surfacer Layer
3. Final Polyurea Armor Layer

2.03 LINER SYSTEM ARMOR LAYER

A. 100% solids, no volatile organic compound (VOC), moisture tolerant, elastomeric polyurea coating to provide infiltration and corrosion protection. Material shall be capable of curing properly given the project site conditions and temperatures conforming to the following minimum physical requirements:

Property	Value
Hardness, D-2240	D 48
Tensile strength, D-412	3315 psi
100% Modulus, D-412	1668 psi
200% Modulus, D-412	1960 psi
300% Modulus, D-412	2650 psi
Tear resistance/DIE-C, D-624	417 pli
Ultimate elongation, D-412	395 %

Taber Abrasion, mg loss CS17	15 mg loss
Flexibility, 1/8" mandrel	Pass
ASTM G210-13 SWAT	Pass

2.04 LINER SYSTEM SURFACER LAYER

A. 100% solids, no volatile organic compound (VOC), moisture tolerant, elastomeric polyurethane coating to provide infiltration and corrosion protection. Material shall be capable of curing properly given the project site conditions and temperatures conforming to the following minimum physical requirements:

Product Type	Value
Density (ASTM D – 1622	6-8 pcf
Compressive Strength 1"	130-180 psi
Closed Cell Content	> 94%
Water Absorption	< 0.03 lbs/sqft
Maximum Service Temp	180 deg
Viscosity (A side) @ 72 deg F	675 cps
Viscosity (B side) @ 72 deg F	200 cps
S.W.A.T (ASTM G210-13)	Pass

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Conduct surface preparation program to include monitoring of atmosphere for hydrogen sulfide, methane, low oxygen or other gases, approved flow control equipment, and surface preparation equipment.

B. Surface preparation methods may include high pressure water cleaning, hydro blasting, abrasive blasting, grinding, detergent water cleaning and shall be suited to provide a surface compatible for installation of the liner system.

C. Surface preparation method shall produce a cleaned, abraded and sound surface with no evidence of laitance, loose concrete, brick or mortar, contaminants or debris, and shall display a surface profile suitable for application of liner system.

D. After the defects in the structure are identified, repair all leaks with a chemical or hydraulic sealant designed for use in field sealing of ground water. Severe cracks shall be "repaired with a urethane-based chemical" sealant. Product to be utilized shall be as

approved by owner/engineer prior to installation. Repairs to exposed rebar, defective pipe penetrations or inverts, etc. shall be repaired utilizing nonshrink grout or approved alternative method.

3.02 REPAIR MATERIALS

A. Repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces. Repair materials shall be compatible with the polyurea coating and shall be applied in accordance with the manufacturer's recommendations.

B. Subject to compliance with the polyurea coating manufacturer's requirements, the following products shall be acceptable as compatible repair base coat materials for polyurea top coating:

1. A hydraulic cement and/or plug shall be used to stop active infiltration. The hydraulic cement and plug shall be suitable for the polyurea top coating, and shall be approved by the polyurea coating manufacturer.

2. Hydrophobic and/or Hydrophilic polyurethane chemical grouts used to stop active infiltration. The chemical grouts shall be suitable for the polyurea top coating, and shall be approved by the polyurea coating manufacturer.

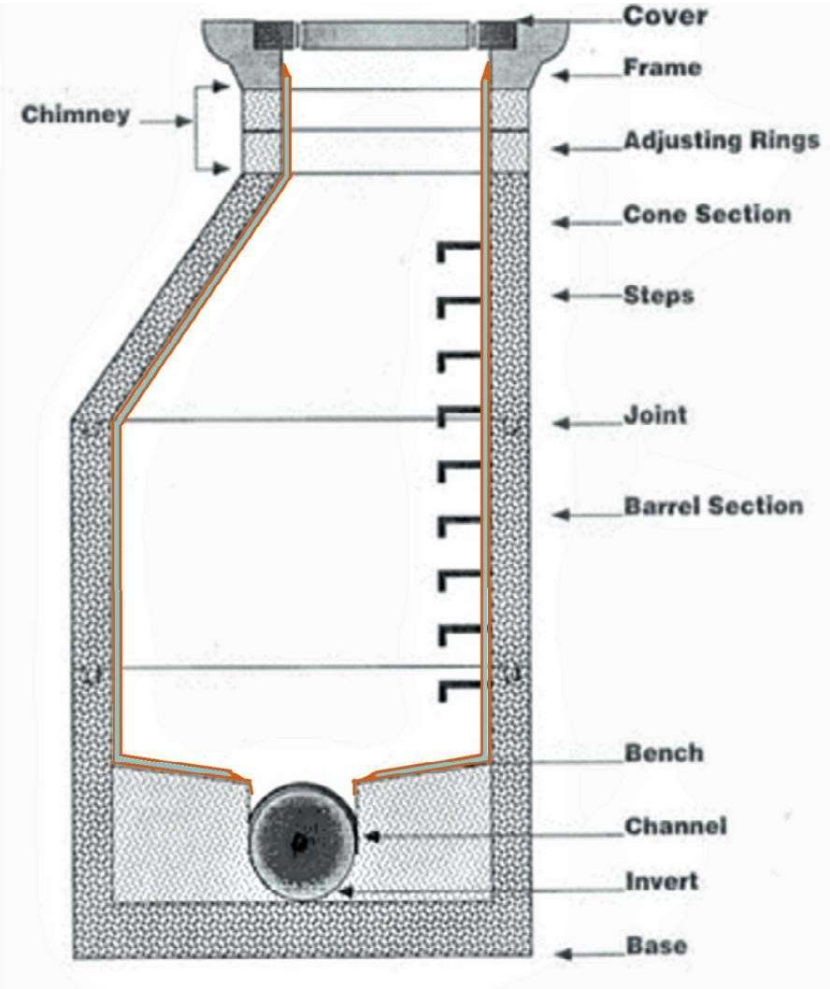
3.03 MATERIAL INSTALLATION

A. Application procedures shall conform to recommendations of the manufacturer, including materials handling, mixing, environmental controls during application, safety and spray equipment.

B. Spray equipment shall be specifically designed to accurately ratio and apply the liner system.

C. Application of multi-layer/component liner system shall be in strict accordance with manufacturer's recommendation. Final installation shall be a minimum of ½" (500 mils).

1. Adhesion Layer (not intended to fill small voids)
2. Surfacer Layer (intended to fill voids, bug holes)
3. Armor Layer



3.04 INSPECTION

A. Final liner system shall be completely free of pinholes or voids. Liner thickness shall be the minimum value as described herein (500 mils).

B. Due to the fast gel and set time of the material, thickness of the application can be verified by awl point depth checks into the surfacer component and physical removal of a small area of the polyurea material. Repair of the test areas to be done immediately after the test.

C. High Voltage Holiday Detection may be used to inspect for pinholes or breaches in the liner system installation.

D. Visual inspection shall be made by the Owner/Engineer. Any deficiencies in the finished liner system shall be marked and repaired according to the procedures set forth by Manufacturer.

E. The manhole/wetwell may be returned to full operational service after the final inspection has taken place.

END OF SECTION

SECTION 15210
PIPING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installing of all pipelines 4-inch diameter and larger shown on the Drawings or as required to complete the Work.

B. Piping less than 4-inch diameter, will be included under other Sections unless otherwise specified.

C. Material to be furnished and installed, but not limited to:

1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joint restraints, joints and jointing materials.
2. Pipe supports other than those specified in Section 15010.
3. Granular material for bedding and encasement of pipelines.
4. Class B concrete as specified in Section 03300 for blocking and encasement of pipelines.
5. Make connections to all existing and/or new facilities and provide temporary services.
6. Install temporary plugs and/or stoppers and harnessing.
7. Test and clean pipelines.
8. Sterilize water mains.

D. The Contractor shall make adequate field measurements before new piping is fabricated.

E. All wall, floor, and roof penetrations and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

F. Instruments which are to be located in pipelines 4-inch in diameter and larger shall be furnished under Division 16 and installed under this Section.

1.02 QUALITY CONTROL

A. Laboratory Services - Laboratory testing services shall be provided as specified under Section 01410 of the Specifications.

B. Field Inspection:

1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replaced with a sound one in a

manner satisfactory to the Resident Project Representative at the Contractor's expense.

2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

C. Field Testing:

1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.

2. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications.

D. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300 showing: layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly.

B. Shop drawings shall be drawn to not less than 1/4-inch scale and show the laying length and piece mark for each section of pipe and fitting.

C. Drawings shall show the position and elevation of valves, pumps, and/or other equipment served by the various pipe systems.

D. The concrete pipe manufacturer's certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification. The certificate shall be signed by an authorized agent of the manufacturer.

E. If directed by the Engineer, each certificate shall be accompanied by a report showing test results compared to specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

F. Before fabrication of any concrete pressure pipe, fittings, or specials, the Contractor shall furnish to the Engineer at least six copies of the design calculations for the pipe showing the calculations to arrive at the gross wrapping stress in wire; initial and resultant stresses in concrete, cylinder, and wire; internal pressure when compression in

concrete is zero; compression strength of concrete at time of wrapping; and calculations to show stress, conditions, and the core and steel when the pipe is simultaneously subjected to the design pressure and external loads. The Contractor shall also furnish the full details of all pipe, specials, and fittings, and a laying schedule showing dimensions, details, and specifications of all pieces.

G. Submit a schedule of all proposed pipe escutcheons.

H. Other submittals may appear in Part 4 of this Section.

I. Any proposed grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series number.

PART 2 PRODUCTS

2.01 RESERVED

2.02 RESERVED

2.03 PROCESS AND PRESSURE PIPE

A. Ductile Iron Pressure Pipe (DIP):

1. Ductile Iron Pressure Pipe (DIP) shall conform to ANSI A21.51 or AWWA C151 and shall be pressure class 350 psi for sizes 12-inch and below, and pressure class 300 psi for larger sizes unless otherwise specified herein. Mechanical joint fittings shall be ductile iron and conform to ANSI A21.10 or AWWA C110 and ANSI A21.53 or AWWA C153. Flanged fittings shall be ductile iron and conform to ANSI A21.15 or AWWA C115. All fittings shall have a pressure rating of 250 psi for all pipe sizes unless otherwise specified.

2. Ductile iron pipe buried underground, unless otherwise specified or shown, shall have rubber gasket (slip-on) type joints in straight runs and mechanical joints with retainer glands each way from bends as shown on the Drawings. The gasket shall be a single molded rubber ring fitted into a specially shaped recess in the bell forming a pressure tight seal. The spigot end of each pipe shall be marked to indicate when the pipe is “home.” Fittings shall have mechanical joints with retainer glands unless otherwise specified or shown. Retainer glands shall be ductile iron. The restraining mechanism shall impart multiple wedging action against the pipe. Restraining devices shall be of heat treated ductile iron. Twist-off nuts shall be used to ensure proper actuation of the restraining device. The mechanical joint retainer gland shall be Ebaa Iron, Inc., Series 1100 Megalug, or equal.

3. Ductile Iron pipe inside buildings or structures shall be joined with flanged, or mechanical joints as shown on the Drawings, or as indicated in the pipe schedule. All mechanical joints shall have retainer glands. Flanges shall comply

with ANSI 21.15 or AWWA C115 and shall be ANSI 125-pound drilling, unless otherwise specified. Flanged joints shall have full face 1/8-inch rubber gaskets or of thickness and type approved by the Engineer. The pipe shall not be threaded or flanged in the field. Flanges shall be firmly bolted with machine, stud, or tap bolts of the proper size and number. Within buildings the bolts and nuts shall be of the best quality mild steel, with true threads, meeting the requirements of ANSI B16.1.

4. Flange adapters for plain end pipe (not fittings), where specified, shown on Drawings, or approved by Engineer shall be a restrained flange adapter. The restraining mechanism shall be multiple gripping wedges set against the pipe wall. Twist off nuts shall be used to ensure proper actuation of the restraining device. The restrained flange adapter shall be Series 2100 Megaflange by Ebaa Iron, Inc., or equal.

5. Wherever specified or shown, mechanical joints shall conform to ANSI A21.11 (AWWA C111), except as specified under Subsection Process and Pressure Pipe Nuts and Bolts.

6. Couplings, if required or permitted, shall be Dresser Style 38, Rockwell, or equal. Restrained coupling shall be Dresser Style 167 Lock Coupling, Rockwell, or equal.

2.04 PROCESS AND PRESSURE PIPE NUTS AND BOLTS

A. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be Cor-Blue coated low alloy steel and have a minimum yield strength of 45,000 psi complying with ANSI A21.11 and AWWA C111.

B. Nuts and bolts encased in grout on concrete pressure pipe shall conform to recommendations of the pipe manufacturer.

C. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A307, Grade B. Higher strength bolts will be acceptable.

2.05 PIPE HANGERS AND SUPPORTS

A. Pipe hangers and supports shall be as specified in Section 15010.

2.06 COATINGS AND LININGS OF PROCESS AND PRESSURE PIPE

A. Coatings and linings where required shall conform to the following requirements unless otherwise indicated in Part 4 of this Section or on the Drawings.

B. Ductile Iron Pipe:

1. Ductile iron pipe, and fittings unless otherwise specified, shall be lined on the interior with a standard thickness cement lining meeting ANSI A21.4 and AWWA C104. A seal coat of bituminous material shall be applied in

conformance with the above Specifications. Piping used for compressed air shall not receive a cement lining.

2. All pipe buried underground shall be coated on the outside with a standard coating of coal tar or asphalt, 1 mil thick unless otherwise specified. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe. The coating materials, after drying 48 hours, shall impart no objectionable color, odor, or taste to water standing in contact with the coating for a minimum of 48 hours.

3. Where approved, the bituminous material used for an interior seal coat may be used for exterior coating of pipe buried underground.

4. All pipe used within buildings and structures and which are to receive field coats of paint shall not be coated with any black bituminous paint. Such pipe, after proper cleaning, shall be painted with one coat of primer paint that is compatible with the field coats. Painting specifications shall be followed for cleaning and painting.

2.07 BEDDING MATERIAL

A. Unless otherwise shown on the Drawings or specified herein, all pipe bedding material shall be in conformance with Section 02200.

B. Concrete bedding and encasement in lieu of standard bedding material shall be installed as shown on the Drawings or specified.

C. All underdrain pipe shall be bedded in MDOT 6A aggregate in lieu of the standard bedding material to a depth shown on the Drawings.

2.08 PIPE ESCUTCHEONS

A. Split-type escutcheons shall be used for piping passing through finished wall, floors, or ceiling. Escutcheons shall be brass plated or chromium plated Model 3A by Ritter, Model 284 by Fee & Mason, or equal.

2.09 WALL PIPE AND SLEEVES

A. Type A Wall Pipe:

1. Cast iron wall pipe shall be used where noted on the Drawings.

2. Wall pipe shall be cast in place with joints as indicated on the Drawings.

3. Where wall pipe is flush with wall, bolt holes shall be tapped for studs.

B. Type B Sleeve:

1. Type B sleeves are for use in exterior walls.

2. Type B sleeves consist of casting in place a cast iron sleeve two sizes larger than the service pipe with couplings on both ends of the sleeve.

3. Service pipe shall be caulked in place with oakum. The oakum shall be covered with a minimum of 1-inch of lead wool on both ends.

C. Type C Sleeve:

1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.

2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.

3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates shall be of delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.

D. Type D Floor Sleeve:

1. Type D sleeves are used for pipes passing through floors.

2. Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

E. Type E Sleeve:

1. Type E wall sleeves shall be used where noted on the Drawings.

2. Type E sleeves consist of casting in place a mechanical joint, cast iron wall sleeves meeting the requirements of AWWA C110 and C111.

3. Each Type E sleeve shall be sealed using plain rubber gaskets, follower glands, and mechanical joint studs meeting the requirements of AWWA C111 on both ends.

F. Type F Sleeve:

1. Type F sleeves shall be used for passing through existing masonry walls.

2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.

G. Type G Sleeve:

1. Type G sleeves used for passing through gastight floors shall be similar to Type C sleeves with the addition of non-shrink grout as shown on the Drawings.

H. Type H Sleeve:

1. Type H sleeves shall be similar to Type G sleeves and used for passing through gastight walls.
2. Type H sleeves shall be as detailed on the Drawings.

I. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

2.10 EXPANSION JOINTS

A. Expansion joints as specified below shall be installed as per Section 15010.

B. Expansion joint construction shall include a neoprene inner tube extending through the bore to the outside edge of both flanges. The inner tube shall be covered with a flexible multiple layer fabric carcass of high strength rubber impregnated synthetic fibers with steel wire or reinforcement rings integral with the fabric to assure sufficient rigidity for vacuum service and high pressure. An outer cover coated with Hypalon paint shall cover the carcass and provide full protection against ozone and weathering.

C. Flange faces shall be neoprene covered and drilled to match drilling in mating flanges. Flange faces shall also be backed by split steel flange retaining rings.

D. All expansion joints shall be suitable for service temperatures of 225 degrees F.

E. All expansion joints used for vacuum service shall be capable of withstanding a 30-inch Hg vacuum.

F. Expansion joints shall have recommended working pressures compatible with the service for which they are installed.

G. All expansion joints shall be equipped with control units to restrict excess axial compression and elongation. Control units shall consist of plates bolted to pipe flanges on each end of the expansion joint and long control bolts extending between pipe flanges.

H. Expansion joints on pipes used for digester gas service shall be the open arch type.

I. Expansion joints on sludge piping shall be of filled arch construction to prevent solids accumulation at the joint.

J. Expansion joints on pipes used for fuel oil and digester gas service shall have Buna-N tubes.

K. For those locations where expansion joints are used to replace valves, spool pieces, or other short sections, standard single arch expansion joints may be of insufficient length. At these locations double, triple, and quad arch expansion joints shall be used as required.

L. Expansion joints shall be Mercer Rubber Company Style 500-700 or equal.

PART 3 EXECUTION

3.01 PRODUCT HANDLING

A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.

B. Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than 4-feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sun's rays.

3.02 PREPARATION OF TRENCH

A. Trench excavation shall conform to requirements of Section 02200.

B. Unless otherwise specified or called for on the Drawings, the width of trench at the top of pipe 24-inch in diameter or less shall not exceed the outside diameter of the pipe or encasement, plus 9-inch on each side of the pipe measured to the face of the trench or to the back of the sheeting when used. For pipe having a diameter greater than 24-inch, the width of trenches at the top of the pipe shall not exceed the outside diameter of the pipe or encasement, plus 15-inch on each side of the pipe measured as specified above.

C. Unless otherwise directed or called for on the Drawings, all pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

3.03 PIPE INSTALLATION

A. General:

1. All loose dirt shall be removed from the bottom and the trench backfilled with specified bedding material to pipe laying grade as detailed on the Drawings. Bell holes shall be dug in the bedding where necessary and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Additional bedding material shall be placed and compacted in 6-inch layers to the height shown on the Drawings or as directed. A mechanical tamper shall be used when installing bedding material for pipe 24-inch diameter and larger. The remainder of the trench shall be backfilled as specified and called for on the Drawings.

2. All pipe shall be laid to lines and grades in conformance with Section 01800.

3. Wherever piping passes through walls or floors, a wall casting pipe or sleeve of the type indicated on the Drawings shall be installed. Escutcheons shall be provided for pipe passing through finished walls, floors, or ceilings.

4. Pipe Anchoring:

   a. Disjointing hydrostatic pressure at bends, valves, plugs, tees, and wyes shall be counteracted by restrained joints or reinforced concrete anchorage as directed on the Drawings or specified.

   b. Thrust blocks shall be installed only where directed or specifically called for on the Drawings, unless otherwise specified. Installation shall be in conformance with Drawings.

   c. Approved joint restraints shall be installed for the distance from each side of each bend, valve, plug, tee, or wye in locations shown or scheduled on the Drawings.

   d. Reinforced concrete joint anchorage shall be installed in conformance with the Drawings.

5. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 5-feet. Pressure piping which carries gases shall be installed with a minimum cover of 4-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation, or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade and alignment shall be approved by the Engineer.

B. Sewer Pipe:

1. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. All pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings. Laser beams shall be used to maintain line and grade unless other methods are approved by the Engineer.

2. Where holes are cast in concrete pipe for handling, they shall be completely filled with non-shrinking mortar after the pipe is placed. A metal disc of proper size may be inserted near the bottom of the hole to retain the mortar until hardened. Wood plugs or rocks intended to plug the hole for retention of the mortar will not be permitted.

3. Joints:

a. O-Ring and Chemically Welded Joints - Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. 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 manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

b. Non-shrinking Mortar Joints - Where specified or shown on the Drawings, joints of concrete pipe sewers shall be thoroughly pointed full inside circumference with a non-shrinking mortar in conformance with the material manufacturer's instructions. The mortar shall be tightly packed and the interior face of the joint shall be left smooth and continuous with the interior face of the pipe. Pointing shall not be done until the backfill over the pipe is placed and compacted.

4. Connections to Existing Sewers:

a. Unless otherwise specified, shown on the Drawings, or directed, connections to existing sewers shall be made as follows:

1) Vitrified clay pipe, plain concrete pipe, and asbestos cement pipe, 15-inch diameter and smaller, and larger diameter at the option of the Contractor, shall be connected by removing a section of the existing sewer and inserting connecting fittings using specified flexible connection couplings.

2) Reinforced concrete pipe and larger sizes of asbestos cement pipe and plain concrete pipe, unless otherwise shown on the Drawings, shall be connected by coring the existing sewer pipe wall and inserting a flexible watertight connector to receive the new pipe.

3) Polyvinyl chloride pipe, ABS pipe, and ABS truss pipe shall be connected in conformance with the manufacturer's recommendations as approved by the Engineer.

b. Connections shall be made in conformance with the jointing materials manufacturer's recommendations and as directed by the Resident Project Representative.

C. Underdrain Pipe:

1. Underdrain pipe shall be laid in a manner conforming to the laying of sewer pipe.

2. In addition, underdrain pipe shall be laid with perforations on the underside.

3. The ends of all pipelines shall be closed with stoppers to prevent entry of soil or other foreign materials.

D. Process and Pressure Pipe:

1. Pipe and appurtenances shall be installed true to line, grade, and location; with joints centered, spigots home; pipe properly supported and restrained against movement; and all valve stems plumb.

2. All elbows, tees, plugs, etc., shall be properly anchored, blocked, or otherwise restrained to prevent movement of the pipe in the joints due to internal or external pressure.

3. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug to the approval of the Resident Project Representative before leaving the Work for the night, and at other times of interruption of the Work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

4. Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The finished cut must be approved by the Resident Project Representative.

5. Joints:

a. Gaskets - Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully “home,” the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced “home” firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

b. Concrete Pressure Pipe Diapers - A band at least 5-1/2-inch wide shall be placed around the outside of concrete pressure pipe, over each joint as recommended by and available from the pipe manufacturer. This band shall serve as a form for placing a 1:2 cement mortar grout in the external recess formed by the face of the bell and the shoulder of the spigot. If the air temperature is below 40 degrees the spigot, bell, and mortar shall be heated. If a reinforced paper joint band is used, it shall be drawn up tight around the pipe and backfill tamped against it up to the springline before pouring the grout. If a cloth band is used, it shall be wired around the outside of the pipe and the grout poured before backfilling.

c. Concrete Pressure Pipe Interior Joints - The interior joint recess of pipe 24-inch and larger shall be pointed using a non-shrinking mortar specified in Subsection 2.01. The inside surface shall be struck off smooth with the pipe interior. On pipe 20-inch and smaller a rope type mastic or trowellable mastic shall be affixed to the concrete face of the bell socket just prior to pushing the spigot into the bell, such that the mastic material squeezes to fill the internal joint recess. Mastics that are detrimental to rubber gaskets shall not be used. Similarly, primers to be used in conjunction with rope type mastics must be kept off gaskets and sealing surfaces of joint rings.

d. Bell and Spigot Lead Joints - If used, the spigot of each pipe shall be fully seated in the bell of the adjoining pipe, adjusted to form a uniform annular space which shall be caulked with sterilized pre-molded rubber, forming a solid packing against which molten lead shall be poured and caulked. Lead, after caulking, shall have a depth of at least 2-inch for pipes 14-inch or less in diameter, and 2-1/2-inch for larger pipe. The melting pot shall be kept near the joint which shall be made by one pouring. Dross shall not be allowed to accumulate in the pot. All Work shall be performed by skilled workmen.

e. Electrical Continuity - Where specified, electrical continuity shall be provided in concrete and steel pressure pipes by welding an insulated #4RR copper cable across joints. The cable shall be welded to the steel of bell and spigot of concrete pressure pipe and across joints including each piece of coupling on jointed steel pipes.

f. Where new piping is to be connected into an existing joint, said joint shall be cleaned sufficiently to result in a liquid- or gastight seal. If applicable, a new gasket shall be supplied and installed.

3.04 SLEEVES AND WALL PIPE

A. Type A wall pipes shall be provided for all pipes passing through the exterior walls unless other sleeve types or wall pipes are designated on the Drawings. Type C sleeves shall be provided in interior walls unless designated otherwise on the Drawings.

B. At all points where piping passes through floors, Type D sleeves shall be provided, unless otherwise designated on the Drawings.

C. Other sleeve types and wall pipe shall be provided as indicated on the Drawings.

D. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

3.05 RESERVED

3.06 LOW PRESSURE AIR ACCEPTANCE TESTS

A. Where approved by the Engineer, the Contractor may perform low pressure air acceptance tests in lieu of infiltration or exfiltration tests for pipes 24 inches in diameter or smaller. Test shall be made in accordance with ASTM F1417-Plastic Gravity Sewer Lines; ASTM C924-Concrete (Circular) Sewer Pipe with Gasket.

1. If the air pressure required for the test is greater than 5.0 psig, the low-pressure air acceptance test shall not be used.

B. The Contractor shall furnish all equipment, materials, and labor, and conduct the tests under observation of the Resident Project Representative.

C. Safety:

1. The air test may be dangerous if the line is improperly prepared. All plugs shall be installed and braced in such a manner to prevent blowouts. No one shall be allowed in manholes during testing.

2. Pressurizing equipment shall include a regulator set at the maximum pressure.

D. Line Preparation:

1. Sewers to be air tested shall be prepared and inspected as specified herein for infiltration and exfiltration tests.

2. Where porous pipe materials are used, the pipe walls may be wetted to temporarily reduce the porosity of the material.

3. All pipe outlets shall be plugged, braced, and the joints restrained adequately to prevent blowouts.

E. Test Procedure:

1. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the invert of the pipe.

2. When a constant pressure of 4.0 psig greater than the average back pressure of any groundwater above the pipe is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes to permit temperature equalization.

3. When temperatures have been equalized and the pressure stabilized at 4.0 psig greater than the average back pressure of any groundwater above the pipe, the air supply shall be shut off or disconnected.

4. Decrease the pressure in the sealed line until the continuous monitoring pressure gauge reads 3.5 psig greater than the average back pressure of any

groundwater above the pipe. When this pressure is reached, timing shall commence with a stop watch.

5. Determine the time, as shown on the stop watch, required for the pressure in the sealed line to drop 1.0 psig.

F. Test Method ASTM F1417-Plastic Gravity Sewer Line:

1. Low pressure air test method shall be the Time-Pressure Drop Method.

2. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.

3. The time required for the pressure in the test section to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM F1417, the section fails. The table below has been reprinted from ASTM F1417 for Contractor's information.

Pipe Diameter, Inches	Minimum Time, Min.: Sec.	Length for Minimum Time, Feet	Time for Longer Length, Sec. (L=Ft)
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470L
24	22:40	99	13.674L

Note: Minimum time applied to all lengths less than or equal to the length shown. For more information, see ASTM F1417, Table 1.

G. Test Method ASTM C924-Concrete (Circular) Sewer Pipe with Gasket:

1. The pressure used in the test shall be the stated pressure plus the average back pressure of any groundwater above the pipe.

2. The time required for the pressure in the test to drop 1.0 psig shall be measured using a stop watch. If the time is less than the time determined from ASTM C924, the section fails. The table below has been reprinted from ASTM C924 for Contactor's information.

D Nominal Pipe Size, Inches	Minimum Time (minutes)/100 feet
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0

24	3.6

H. Air Pressure Adjustment for Groundwater:

1. In areas where groundwater is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple, approximately, 10-inch long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the groundwater level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube.

2. The air pressure correction, for the average back pressure of the groundwater above the pipe, shall be calculated by subtracting the average invert elevation from the measured groundwater elevation and dividing the difference by 2.31 psi/feet. This correction must be added to the test pressures stated in the test procedure.

3.07 RESERVED

3.08 PRESSURE AND LEAKAGE TESTS FOR PROCESS AND PRESSURE PIPE

A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all lines including the joint between existing and new pipes unless otherwise directed by the Engineer.

B. Tests shall be conducted on all pipelines or valved sections thereof as directed by the Resident Project Representative. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilling prior to testing, unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.

D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water

added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 9 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.

E. Lines that conduct fuel oil, gasoline, or chemicals that would have a deleterious effect upon the pipeline or process when mixed with water shall be purged after the pressure and leakage tests. Purging shall be performed with air or an inert gas such as nitrogen or carbon dioxide. Purging shall be continued for a minimum of two hours after all visible water has disappeared.

F. Testing of lines governed by other authorities, i.e. natural gas, shall be witnessed and approved by the authority.

3.09 RESERVED

3.10 INSTRUMENTATION CONNECTIONS

A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.

B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.

C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.

D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

PART 4 SPECIAL PROVISIONS

None.

END OF SECTION

SECTION 15211
SMALL PIPING AND VALVES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing all pipelines and valves less than 4-inch in diameter as shown on the Drawings or as required for a complete piping system for each service or combination of services except the piping and valves included in Section 15400 and Section 15500.

B. Each piping system shall be adequate to conduct and control the flow of process water, plant water, non-potable water, instrument air, compressed air, vacuum, natural gas, sewage gas, propane, fuel oil, chemicals, sewage, sludge, sampling or other uses as specified or shown on the Drawings.

C. This Section includes, but is not limited to:

1. Securing and bearing the cost of all permits, certificates, and inspection as required by local regulations and state codes.
2. All pipe, fittings, and connections for water supply to equipment and waste to drains.
3. Valves less than 4-inch in diameter, control devices, pipe hangers, anchors, supports, and sleeves for the piping systems covered under this Section.
4. Hose bibbs, sill cocks, and hydrants.
5. Non-potable water supply, drain lines, and connections to boilers, pump priming systems, pump gland seals, valve operating cylinders, or other equipment requiring these services.
6. Compressed air piping, valves, connections to valve operators, and other equipment requiring compressed air.
7. Compressed air, non-potable water, natural gas, propane, vacuum, deionized water, and other services as required for laboratory service.

D. The Contractor shall remove all existing pipelines and valves less than 4-inch in diameter that are indicated on the Drawings to be removed except piping and valves included in Section 15400 and Section 15500. Removals shall be done in accordance with the requirements of Section 02110.

E. The Contractor shall relocate existing piping and valves less than 4-inch in diameter, except piping and valves included in Section 15400 and Section 15500, which interfere with Work under this Section or any Section of the Specifications.

F. The Contractor shall furnish, install, and remove all temporary piping and valves that are required to maintain processes in operation during construction.

G. All wall, floor, and roof penetration and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

H. Instruments which are to be located in pipelines to be furnished under Division 16 shall be installed under this Section.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Drawings shall include plan dimensions to and elevations of sleeves, inserts, and anchors, the size and location of each run of pipe, and the location of valves and unions.

b. Manufacturer's literature, catalog data, specifications, and illustrations shall be bound in a brochure which includes a complete bill of materials.

2. Information for the Record:

a. Operation and maintenance manual.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Copper Pipe and Tubing shall be manufactured in accordance with ASTM B88. Type L hard temper shall be used above ground and inside of structures for compressed air, hot and cold potable water, plant water, vacuum, and other services unless another type of pipe is specifically called for. Type K soft temper shall be used where underground piping is installed. Fittings and unions shall be solder joint fittings of cast bronze manufactured in accordance with ASTM B62 and with ends complying to ANSI B16.18 or wrought copper manufactured in accordance with ASTM B75 and with ends complying to ANSI B16.22. Unions shall be cast bronze and shall be installed adjacent to valves and equipment and as required to assemble the piping but not less than one union shall be included in each run. Threaded adapters shall be installed on each side of valves in copper lines. Where joints are made between pipes of different materials, dielectric couplings shall be installed. Pipe nipples shall be standard weight seamless red brass pipe ASTM B43. Solder joints shall be made in conformance with ASTM B828 Flux conforming to ASTM B813 shall be applied. Materials used for solder joints in all potable water services shall contain less than 0.2% lead and comply with ASTM B32.

B. Steel Pipe, unless otherwise noted, shall be used for all aboveground natural gas, digester gas aboveground only, aboveground fuel oil, and scum. Pipe shall be ASTM A53

Schedule 40, unless otherwise noted or where code requirements differ, with standard weld or malleable iron fittings. Unions shall comply with ANSI B16.3.

1. Steel piping installed above ground, unless otherwise noted, shall be Schedule 40 pipe with standard malleable iron screwed fittings. Unions shall be 250 pound screwed malleable iron with iron to iron seats. On pipes 2-inch and larger, ASTM A105 companion flanges shall be used in lieu of unions. For natural gas through 2-inch, fittings shall be 3,000-pound forged steel socket weld. For natural gas, digester gas, and fuel oil, pipe 2-1/2-inch and larger, ASTM A234 weld fittings and ASTM A105 flanges shall be used.

2. Steel piping installed underground, unless otherwise noted, shall be Schedule 40 plastic coated at the factory with Scotchkote 212 by 3M or equal. Pipe fittings through 1-1/2-inch shall be 3000-pound forged steel socket weld, and 2-inch and larger shall be ASTM A234 weld fittings. Joints shall be welded, primed, and wrapped double the manufacturer's recommended thickness with Tapecoat TC Primer and Tapecoat CT, or equal.

3. Where couplings are called for on gas piping, they shall be Dresser Style 38, or equal. The couplings shall be specifically designed for digester or natural gas, middle ring width shall be 5-inch long.

C. PVC Pipe and fittings shall be composed of Class 12454-B rigid PVC compound in conformance with ASTM D1784 (formerly classified Type I, Grade 1). Pipe shall be Schedule 80 with a design stress of 2000 psi in conformance with ASTM D1785. All joints, unless otherwise shown on the Drawings, shall be solvent welded in conformance with ASTM D2855. Joint solvent shall be as recommended by the pipe manufacturer and shall comply with ASTM D2564. In pressure or vacuum lines and in gravity drains 1-inch diameter and less, the fittings shall be Schedule 80 and shall conform to ASTM D2467. For gravity drains greater than 1-inch diameter, the fittings shall conform to the requirements of ASTM D2665. PVC pipe shall be used for acid-resistant services and all lines carrying chlorine solution, sodium hypochlorite, De-ionized (DI) water and other chemicals unless otherwise shown on the Drawings or specified.

2.02 VALVES

A. Unless otherwise specified or shown on drawings, valves installed in pipelines 3-1/2-inch diameter and smaller for process water lines shall be gate valves; for compressed air and vacuum, globe valves; for natural and sewage gas lines, lubricated plug or eccentric nonlubricated plug valves; and for gas lines less than 2-inch diameter tapered nonlubricated plug cocks; for fuel oil, ball valves; for sludge, eccentric nonlubricated plug valves. Valves for other types of services when required will be specified under that Section.

B. Gate Valves shall be 150-pound, all bronze, rising stem, solid wedge disc furnished with screwed or flanged ends as required. Gate valves shall be Crane No. 431, Jenkins No. 47-U, Powell No. 514/515, or equal.

C. Globe Valves shall be 150-pound, all bronze body with renewable plug-type disc of 500 Brinell Hardness Stainless Steel. The seat ring shall be screwed-in and of the same material as the disc. Globe valves shall be Powell No. 2600, Crane No. 14-1/2P, Jenkins No. 2032, or equal.

D. Ball Valves through 2-inch shall be screwed end bronze, two-piece, 125 psi, Teflon seats, bronze trim, and blowout-proof stem, Nibco No. T-580-BR-Y-20, or equal.

E. Butterfly Valves shall be AWWA, Class 150 B, wafer body equipped for ANSI 125-pound flanges. Butterfly valves shall provide bubble-tight shutoff to 150 psig cold water pressure. The valve body shall be made from ASTM A126, Grade B cast iron or equal. The valve disc shall be made with nickel-coated cast iron, bronze, or equal. Valve shall have bronze shaft bearings, O-ring shaft seals, and EPDM valve body seat Keystone Figure 239, or equal. Valves shall be hand lever actuated.

F. Check Valves shall be 200-pound, all bronze body with bronze disc, Y-pattern, with flanged or screwed ends as required. The check valves shall be Crane No. 36, Powell 560-Y/561-Y, Jenkins 762-A, or equal. Non-slam check valves shall be used on all pipelines operating at 25 psig or higher pressure and shall be Valve and Primer Corporation, Series 300 or equal.

2.03 PVC VALVES

A. PVC Ball Valves shall be used in all PVC lines under this Section. Ball valves shall be PVC body, Hayward TBH Series True Union; or equal.

B. PVC Butterfly Valves:

1. Butterfly Valves shall be made of Class 23447-B rigid PVC compound in conformance with ASTM D1/84 (formerly classified Type IV, Grade 1).
2. Shaft shall be 316 stainless steel. Seats and secondary seals shall be Viton.
3. Bearings shall be glass filled Teflon. Butterfly valves shall have a pressure rating of 150 psi at 70 degrees F.
4. Valve bodies shall be the wafer type compatible with 150-pound ANSI flanges.
5. Valves which are scheduled to be motor operated shall be furnished with mounting saddle. Manually operated valves shall be furnished with lever operators.

C. Check Valves:

1. Check Valves shall be made of Class 12454-B rigid PVC compound in conformance with ASTM D1784 (formerly classified Type I, Grade 1).
2. All check valves shall have Viton seals.
3. Check valves 4-inch size and smaller shall be true union ball checks.

D. PVC Pressure Relief Valves shall be Wallace & Tiernan No. U-23655, Fischer & Porter, or equal, with 1-inch female NPT BPV connections. These shall not be used on chlorination systems.

2.04 RESERVED

2.05 RESERVED

2.06 RESERVED

2.07 RESERVED

2.08 ELECTRIC VALVE OPERATORS (OPEN-CLOSE)

A. Electric operators shall be sized and geared to meet the torques required at a valve opening and closing speed of 2 to 8 seconds per 90-degree rotation. The operator shall be rated for 25% duty cycle at maximum rate output.

B. Operators shall be powered by 115 v, single phase, 60 Hz current and shall operate in any mounting attitude.

C. Operators shall have thermal overload protection, reversing magnetic starter, and a explosion proof NEMA 7 enclosure for all electrical components. The starter shall be capable of receiving contact closures from remote sources to actuate the operator in either direction. The operating motor shall be provided with surge suppression to limit voltage transients. The surge suppression device shall be equal to Electrocube Part No. RC1782, sized as required to suit the motor characteristics.

D. Adjustable limit switches shall be provided. Two limit switches shall be used for de-energizing operator once the fully open position or fully closed position of the valve is reached. Two limit switches shall be used for remote indication of end positions. Limit switches shall be single pole double throw snap acting totally enclosed and rated at 250 VAC.

E. Each operator shall be equipped with a manual override feature with manual lockout switch to prevent electrical operation when in the manual mode. Upon completion of manual operation, the operator will automatically return to the electrical mode.

F. Each operator shall be supplied with local indicator for visual valve position and an electro-mechanical brake to minimize overrun.

G. Electric motor valve operators that are to be supplied with butterfly valves shall be sized for 1-1/2 times the valves rated torque or a minimum of 400-inch-pound, whichever is greater.

H. The operators shall be a product of Beck kit 12-9577-29, Rotork SI3 SI4, or engineer preferred equal **(Addendum 001, Issued on 06-09-2025).** Operators shall have easily identifiable terminal blocks for all external power and control connections.

2.09 RESERVED

2.10 RESERVED

2.11 RESERVED

2.12 RESERVED

2.13 RESERVED

2.14 RESERVED

PART 3 EXECUTION

3.01 INSTALLATION

A. Cutting of all pipe shall be done with sharp tools. The ends of each pipe shall be reamed until all burrs or fins are removed. Full tapered threads shall be used throughout and threaded joints shall turn up perfectly tight without the use of filling substances. A standard pipe joint paste or tape suitable to use of pipe shall be used on the male threads only, and none shall be allowed to accumulate on the inside of the pipes. All connections between pipe, pipe hangers, and equipment shall be made with an approved dielectric insulating material. Dielectric unions or insulated couplings shall be installed between any dissimilar metallic piping materials or at connections between dissimilar metallic pipes and equipment, tanks, etc.

B. Pipe joints shall conform to respective industry standards.

C. Expansion and contraction of the piping system shall be provided for by the use of swing joints, right angle loops, or approved expansion joints. Branch connections shall have three elbow spring pieces to allow for movement. Unless specified in Part 4, the piping system shall provide for the expansion as required in Section 15010. An expansion joint is also required at all building isolation or expansion joints.

D. Interior and exterior pipelines shall be installed and graded in accordance with State and/or Local Codes. Interior pipes shall run at right angles or parallel to building walls, placed as close as practicable to the ceiling and/or walls, and supported according to Section 15010. Drain valves shall be installed at all low points.

E. Pipe groups shall be run parallel with pipes of other trades, and wherever practicable, all piping shall be supported on common group hangers unless pitch of pipe as hereinbefore mentioned is required.

F. The piping shall be installed in a workmanlike manner and shall avoid interference with columns, beams, equipment, and other piping or fixed construction. A minimum of 7-feet of headroom shall be maintained at any point including stairs.

G. Type C wall sleeves shall be provided for all pipes passing through exterior walls unless other sleeve types are noted on the Drawings. Type C sleeves shall also be provided in interior walls where indicated on the Drawings, Type D floor sleeves shall be used where piping passes through floor. Other sleeve types shall be used where shown on the Drawings.

H. Buried pipe shall be firmly bedded the full length with the exception where bell holes are required. Buried piping located less than 3-feet below a building slab or footing shall be encased in concrete. Where unstable soil conditions occur under buildings, support shall be made from the underside of the structural slab by an approved type hanging device embedded in the concrete.

I. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 42-inch. Pressure piping which carries gases shall be installed with a minimum cover of 3-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer's recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade shall be approved by the Engineer.

J. Where PVC piping is laid in a trench, the bottom of the trench shall be well graded and compacted to insure even bearing for the full length of the pipe and the pipe shall be snaked at approximate 50-foot intervals to provide for expansion or contraction. Prior to testing the pipe, the pipe shall be center loaded with backfill between joints before testing to prevent the pipe from arching or whipping under pressure. During backfill the line shall be pressurized to 25 psi to minimize impact damage.

K. All valves shall be installed with their stems horizontal or above. As far as possible, all valves of the same type shall be of the same manufacturer.

L. Solenoid operated valves shall be installed in horizontal lines with the solenoid mounted vertically and upright.

M. The T-drill method manufacturing tees in continuous copper tubing is not acceptable.

3.02 EQUIPMENT CONNECTIONS

A. The Contractor shall make all connections where required between the various piping systems and all pieces of equipment. This shall include adapters, traps, backwater valves, or other fittings required when not furnished with the equipment.

B. Unions - Provide a union or flange in piping connections to each valve, device, or item of equipment, and elsewhere as required to makeup or disconnect piping. Each union shall be so installed as to permit the removal of parts and equipment for inspection and cleaning, and shall be installed in a position which will permit the valve device or part to be removed without disconnection of any piping except unions. Union and flange shall be installed in such a position as will be accessible for disconnection items which are to be screwed. All ground joint unions on copper lines shall be cast brass or bronze. Wrought copper unions are not to be used. All unions, where possible, shall be brass to MPT type.

3.03 INSTRUMENTATION CONNECTIONS

A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.

B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.

C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.

D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

3.04 PRESSURE AND LEAKAGE TESTS FOR (LIQUID) PROCESS AND PRESSURE PIPE

A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all liquid conducting lines unless otherwise directed by the Engineer.

B. Tests shall be conducted on all liquid conducting pipelines or valved sections thereof as directed by the Resident Engineer. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilled prior to testing, unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.

D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 50 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.

E. Lines that conduct fuel oil, gasoline, or chemicals that would have a deleterious effect upon the pipeline or process when mixed with water shall be purged after the pressure and leakage tests. Purging shall be performed with air or an inert gas such as nitrogen or carbon dioxide. Purging shall be continued for a minimum of two hours after all visible water has disappeared.

F. Testing of chlorination system piping shall also comply with the provisions of Section 11235.

3.05 RESERVED

3.06 RESERVED

3.07 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 MOTORIZED VALVE SCHEDULE

A. The following letter designations are used in the Valve Schedule:

Mark Designation			
P-HD-14S	First Letter	=	Type of Valve
	Second Letters	=	Location
	Number and Letter	=	Valve Number

Type	**Location**
BP - Ball Valve	AEA - DAF Building, Basement Level
GV - Gate Valve	AEB - DAF Building, Main Ground Level
PV - Plug Valve	AEF - DAF Building, DAF Tanks

AEG - DAF Building, DAF Tank Tunnels
FJ - Gravity Thickener Building, Basement Level

Fittings

F - Flanged
SC - Screwed

Service

C - Chlorine
DW - Polymer Dilution Water
IC - Iron Chloride
NPW - Non-potable Water
PW - Potable Water
PL - Polymer

Operator Designation

C - Chain Wheel
MOI - Motor Operated with Integral Control

B. The Schedule is as follows:

Mark	Size (in.)	Fitting	Service	Operator	Drawing No.
Plug Valves					
West Manhole Valve 1	12	F	NPW	MOI	C-0.3
West Manhole Valve 2	12	F	NPW	MOI	C-0.3
East Manhole Valve 1	12	F	NPW	MOI	C-0.3
East Manhole Valve 2	12	F	NPW	MOI	C-0.3

4.02 PIPING SERVICE MATERIAL REQUIREMENTS

A. The following are the material classifications to be used for the piping service identified.

Service	Piping
Scum Spray Bar	PVC

END OF SECTION