Division 33

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SECTION 330500
HYDROSTATIC PRESSURE AND LEAKAGE TESTING

PART 1 – GENERAL

1.01 REFEERENCES

A. The latest version of all referenced standards shall apply.
   1. AWWA C600
   2. ASTM F2164

1.02 WORK INCLUDED

B. Testing of all hydraulic structures, pressure and non-pressure piping for leakage as specified.
   1. The CONTRACTOR shall furnish all labor, equipment, test connections, vents, water and materials necessary for carrying out the pressure and leakage tests.
   2. CONTRACTOR shall use potable water only.

B. All testing shall be witnessed by the ENGINEER or OWNER.

PART 2 PRODUCTS

(not used)

PART 3 – EXECUTION

3.01 LEAKAGE TESTS

A. If vacuum testing can not be performed on the concrete structures, a hydrostatic leakage test shall be performed.

B. Tanks, vaults, wells and other fluid containing structures, (excluding manholes), shall be tested after backfilling by filling the structure with water to overflowing, or other level as may be directed by the ENGINEER, and observing the water surface level twenty-four hours thereafter.
   1. When testing absorbent materials such as concrete, the structure shall be filled with water at least 24 hours before the test is started.

C. The exterior surface, especially at the construction joint, will be inspected for leakage during and upon completion of the 24-hour test.
   1. Leakage will be considered to be within the allowable limits when there is no visible sign of leakage on the exterior surface and where the water surface does not drop except as associated with evaporation.
   2. A slight dampness on the exterior wall surface during the test period will not be considered as leakage, except in the case of prestressed concrete structures.

3.02 TESTS ON PRESSURE PIPING FOR TRANSPORT OF WATER OR SEWAGE (FORCE MAINS)

A. General
   1. The newly constructed water or sewer main shall be pressure tested according to ANSI/AWWA C600, Section 4: Hydrostatic Testing.
   2. Take all necessary precautions to prevent dirt, debris, or other foreign material from entering the water or sewer main, services, or appurtenances. Remove such material from the water or sewer main, services or appurtenances at no additional expense to the Contract.

3. Pipelines designed to transport water or sewage under pressure shall be tested hydrostatically and for leakage prior to being placed in service.
4. The length of piping and sections included in the tests shall meet the approval of the ENGINEER, but shall not exceed 1,000 lineal feet.
5. The pipe shall be tested at whichever pressure is greater:
   1) 150 psi
   2) 1.5 times the working pressure of the pipe - See Contract Plans for Working Pressure.
6. Equipment in or attached to the pipes being tested shall be protected. Any damage to such equipment during the test shall be repaired by the CONTRACTOR at his expense.
7. When piping is to be insulated or concealed in a structure, tests shall be made before the pipe is covered.
8. All fittings, hydrants and appurtenances must be properly braced and harnessed before the pressure is applied. Thrust restraining devices which will become a part of the system must also be tested at the test pressure.
9. CONTRACTOR shall use potable water only. Water for flushing and testing lines shall be provided by the CONTRACTOR.
10. If the line fails the test, the CONTRACTOR shall explore for the cause of the excessive leakage and after repairs have been made the line shall be retested. This procedure shall be repeated until the pipe complies at no additional expense to the Contract and without extension of time for completion of the work.

B. Pressure Test
1. Test pressure shall be as scheduled at 1-1/2 times working pressure or where no pressure is scheduled at 150 psi.
2. Test pressure shall be held on the piping for a period of at least 2 hours, unless a longer period is requested by the ENGINEER.
3. The pressure test passes if the pressure remains within 5 psi of the original pressure.

C. Leakage Test for Ductile Iron and PVC Pipe
1. The leakage test shall be conducted concurrently with the pressure test.
2. The rate of leakage shall be determined at 15-minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three (3) consecutive 15-minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.
   a. At the completion of the test, the pressure shall be released at the furthermost point from the point of application.
3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating tests.
4. Unless the local standards are more stringent, use the following formula for allowable leakage (gph).

$$L\ (gph) = \frac{SD(P)^{1/2}}{133{,}200}$$

S = Length of pipe tested (feet).
D = Nominal diameter of the pipe, (inches).
P = Average test pressure during the leakage test, (psig).

5. Regardless of the above allowables, any visible leaks shall be permanently stopped.

D. Leakage Test for HDPE Pipe

1. The leakage test shall be conducted concurrently with the pressure test.
2. Shall be tested per ASTM F2164 – Non-Monitored Make-up Water Test
   a. The test procedure consists of initial expansion phase and test phase.
   b. Initial expansion phase
      1. Make-up water is added as required to maintain the test pressure for four (4) hours.
   c. Test phase
      1. The test pressure is reduced by 10 psi.
      2. If the pressure remains steady (within 5 % of the target value) for one (1) hour, no leakage is indicated.
3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating tests.
4. Any visible leaks shall be permanently stopped.

E. Leakage Test for PCCP Pipe
1. The leakage test shall be conducted concurrently with the pressure test.
2. The rate of leakage shall be determined at 15-minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three (3) consecutive 15-minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.
   a. At the completion of the test, the pressure shall be released at the furthermost point from the point of application.
3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating tests.
4. The line will not be accepted until this measured quality is less than 10 gallons per inch of diameter per mile of pipe per 24 hours. All visible leaks must be repaired regardless of the measured leakage.
5. Regardless of the above allowables, any visible leaks shall be permanently stopped.

END OF SECTION

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SECTION 330510
DISNFECTION AND BACTERIOLOGICAL TESTING

PART 1. GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall provide disinfection and testing services as specified herein.

B. **All costs required to perform disinfection and testing shall be borne by the CONTRACTOR until laboratory results are accepted by the NYS, and local, Departments of Health.**

1.02 REFERENCES

A. Applicable Codes, Standards and Specifications

1. American Water Works Association (AWWA) C-651, latest revision for Disinfecting Water Mains.

2. AWWA C-652, latest revision for Water Tank Disinfection.

3. AWWA B-300, latest revision for Hypochlorites.

4. AWWA B-301, latest revision for Chlorine Gas.

5. Recommended Standards for Water Works, latest revision, Section 7.0.18, for Disinfection of Finished Water Storage.

6. Recommended Standards for Water Works, latest revision, Section 8.7.7, for Disinfection of Distribution System Piping and Appurtenances.

1.03 SUBMITTALS

A. CONTRACTOR to prepare and submit to ENGINEER reports of purging and disinfecting activities.

B. All test results must be submitted to the ENGINEER directly from the Laboratory.

PART 2. PRODUCTS

(Not used)

PART 3. EXECUTION

3.01 DISINFECTION

A. Compliance

1. Disinfect all potable water pipes and appurtenances in accordance with AWWA C651.

2. Conform to provisions of the most recent AWWA C-651, latest revision for water line disinfection.

3. Conform to provisions of the most recent AWWA C-652, latest revision for water tank disinfection.

4. Comply with all requirements of the New York State Department of Health for disinfection of potable water lines, valves, hydrants, storage tanks, and appurtenances.

5. Comply with all requirements of the New York State Department of Health for disinfection of potable water lines, valves, hydrants, and appurtenances.

B. Products

1. The Tablet Method is NOT accepted.

2. Acceptable disinfectants are:

   a. Hypochlorites.

3. Test Kits

   a. High range test kit for chlorine residual (0-200 mg/1) Hach Chemical Co. Model CN-21P.

   b. DPD chlorine residual test kit (0-3.5 mg/1) Hach Chemical Co. Model CN-66.

   c. Test kits to remain property of the Contractor.

C. Flush mains with clear water at a minimum rate of 2.5 fps prior to disinfection. See Table 1.

TABLE 1 – WATER MAIN FLUSHING DATA		
PIPE DIAMETER (INCHES)	**FLUSHING RATE GPM @ 2.5 fps**	**HYDRANT OPENINGS @ 40 psi**
2	25	one - 2-1/2
4	100	one - 2-1/2
6	220	one - 2-1/2
8	390	one - 2-1/2
10	610	one - 2-1/2
12	880	one - 2-1/2
18	1980	two - 2-1/2
24	3510	one - 4-1/2 and one - 2-1/2
30	5510	one - 4-1/2 and two - 2-1/2

D. Hypochlorites: Apply solutions to water mains with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions.

E. Application (Continuous Feed Method).
1. Connect chlorinator or force pump to water main upstream from point of repair or replacement, or new lines.
2. Proportion application rate of chlorine solution to obtain a minimum concentration of 50 mg/1 of available chlorine. Use high range test kit to determine concentration. See Table 2.

TABLE 2 - QUANTITY OF DISINFECTANT REQUIRED FOR 50 mg/l OF AVAILABLE CHLORINE PER 100 FT. OF PIPE							
PIPE DIAMETER (INCHES)	**POUNDS**		**OUNCES**			**QUARTS**	
	Cl GAS	**SOLUTION 70%**	**HYPOCHLORITE 70%**	**14.7%**	**5.25%**	**14.7%**	**5.25%**
2	0.1	0.1	0.2	0.7	2.1	0.1	0.1
4	0.1	0.1	0.6	3.0	8.3	0.1	0.3
6	0.1	0.1	1.4	6.7	18.7	0.2	0.6
8	0.1	0.2	2.5	11.8	33.2	0.4	1.1
10	0.2	0.3	3.9	18.5	51.8	0.6	1.6
12	0.3	0.4	5.6	26.7	74.7	0.8	2.3
18	0.6	0.8	12.6	60.0	168.0	1.9	5.3
24	1.0	1.4	22.4	107.0	298.0	3.4	9.3
30	1.6	2.2	35	167	467	5.2	14.6

3. In the absence of a meter, determine rate either by placing a pitot gage at discharge or by measuring the time to fill a container of known volume. See Table 3.

TABLE 3 - TIME FOR DISINFECTANT TO FLOW THROUGH 100 FT. OF PIPE - MINUTES			
PIPE DIAMETER (INCHES)	**@ 25 GPM**	**@ 100 GPM**	**@ 500 GPM**
2	1.0	0.25	0.05
4	3.0	0.75	0.15
6	6.0	1.5	0.3
8	10.0	2.5	0.5
10	16.0	4.0	0.8
12	24.0	6.0	1.2
18	53.0	13.25	2.6
24	94.0	26.0	5.2
30	147.0	37.0	7.4

4. Continue to apply chlorine solution until it reaches discharge. Check for the presence of chlorine at discharge by adding an orthotolidine reagent. In the presence of chlorine the reagent will turn red.
5. Maintain chlorinated water in the main for a minimum of 24 hours. At the end of this period chlorine concentration shall be at least 25 mg/1. Use high range test kit to determine concentration.
6. Operate all valves and hydrants to insure their proper disinfection.
7. Prevent back flow of super chlorinated water into existing distribution system.

F. Final Flushing:
1. Give the OWNER 72-hour notice prior to flushing any section of the main. The OWNER will review both the time and rate of flushing.
2. After a 24-hour retention period, flush main until maximum chlorine concentration is 1.0 mg/1. Use DPD chlorine residual test kit.
3. Water used to disinfect the water mains shall be dechlorinated prior to discharge. Only water free of chlorine (< 0.1 mg/l total residual chlorine) can be discharged to a surface water and the discharge of the chlorine-free water shall be performed in a non-erosive-manner that will not adversely affect plants and animals. The discharge shall comply with applicable State regulations for waste discharge.
4. Sodium thiosulfate or approved equal shall be used as the dechlorinating agent.

3.02 BACTERIOLOGICAL TESTING:

A. Test water main in the presence of the ENGINEER for bacteriological quality before putting watermain into service.

B. After the chlorination procedures are completed, and before the installed watermain is placed in service, a minimum of two (2) samples, 24-hours apart, shall be taken from the full pipe and tested for coliform organisms, HPC bacteria, and chlorine residual in accordance with the latest edition of Standard Methods for Examination of Water and Wastewater. Testing shall be by either the multiple tube fermentation or membrane filter technique.

C. Each water sample shall also be tested to assure that no offensive odor exists due to chlorine reaction or excess chlorine residual.

D. Should test results prove any part of the system bacteriologically unsafe, repeat disinfection and testing procedures until two (2) consecutive samples are negative.

E. Samples shall also be taken from the source water inflowing to the watermain and tested to determine if coliforms are present in the typical potable water source(s).

F. Tests shall be conducted by a laboratory approved by the New York State Health Dept.

3.03 PLACEMENT INTO SERVICE

A. **No new or existing water infrastructure affected by the work, including but not limited to storage tanks, water mains, hydrants, or service connections, shall be placed into service until the engineer of record has received written authorization from the local department of health**.

B. If the water samples are negative, and the local DOH has provided approval, then the piping may be placed in service.

END OF SECTION

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SECTION 330520
IDENTIFICATION FOR PROCESS PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

5. Minimum Letter Size: 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number,

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: white.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

F. Fasteners: Stainless-steel.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 331110
FACILITY DISTRIBUTION PIPING AND VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water, sewer, sludge distribution piping, valves, and related components outside the building.

B. Refer to Drawings for type of pipe and location of use.

C. EPDM: Ethylene propylene diene terpolymer rubber.

D. HDPE: High density polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
   2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

   1. Comply with NSF 14 for plastic potable-water-service piping.
   2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Engineer no fewer than two days in advance of proposed interruption of service.

1.7 COORDINATION

A. Coordinate connection to water main with utility company and/or Owner.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

    a. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and blue coded stainless-steel bolts.

B. 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 or AWWA C153, ductile-iron compact pattern.
2. Gaskets:
    a) AWWA C111, rubber.
    b) Field Lok 350 joint restraint where indicated.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:
    a. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
    b. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.3 HDPE PIPE AND FITTINGS

A. HDPE, AWWA Pipe: AWWA C906, ASTM D 3350, SDR No. 11; with PE compound number required to give pressure rating not less than 160 psig.

1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psi.

2.4 PVC PIPE AND FITTINGS

A. PVC, ASTM D 2241, SDR 21, with bell end with gasket, and with spigot end.
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Gaskets: AWWA C111, rubber.
   2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.5 SPECIAL PIPE FITTINGS

A. Ductile-Iron Rigid Expansion Joints:
   1. Description: 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.
      a. Pressure Rating: 250 psi minimum.
      b. Expansion Required: 6 inches.

B. Ductile-Iron Flexible Expansion Joints:
   1. Description: 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 sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 minimum.
      b. Offset: 6 inches.
      c. Expansion Required: 6 inches.

C. Ductile-Iron Deflection Fittings:
   1. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-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.
      a. Pressure Rating: 250 psi minimum.

2.6 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
   1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

      a. Standard: AWWA C219.
      b. Center-Sleeve Material: stainless steel.
      c. Gasket Material: Natural or synthetic rubber.
      d. Pressure Rating: 150 psi minimum.
      e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:
   1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

      a. Standard: AWWA C219.
      b. Sleeve Material: stainless steel.
      c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
      d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
      e. Pressure Rating: 150 psi minimum.
      f. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:

   1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
   2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

2.7 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:

   1. Standards: ASTM A 674 or AWWA C105.
   2. Form: tube.
   3. Material: High-density, crosslaminated PE film of 0.004-inch minimum thickness.
   4. Color: black.

2.8 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

   1. Buried Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psi.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2. Non- buried OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psi.
3) End Connections: Flanged.

2.9 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER" or “SEWER,” and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.10 CHECK VALVES

A. **All check valves shall be provided with external spring-loaded levers.**

B. AWWA Check Valves:
1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

a. Standard: AWWA C508.
b. Pressure Rating: 175 psi.

2.11 BUTTERFLY VALVES

A. AWWA Butterfly Valves:
   1. Description: Rubber seated.

      a. Standard: AWWA C504.
      b. Body: Cast or ductile iron.
      c. Body Type: flanged.
      d. Pressure Rating: 150 psi.

2.12 PLUG VALVES

A. Plug Valves:
   1. Description: Resilient-seated eccentric.

      a. Standard: MSS SP-108.
      b. Body: Cast iron.
      c. Pressure Rating: 175 psi minimum CWP.
      d. Seat Material: Suitable for potable-water service.

2.13 PRESSURE RELIEF VALVES

A. Pressure Relief Valves:
   1. Description: Resilient-seated eccentric.

      a. Standard: ASTM A126
      b. Flange: 125# ANSI
      c. Body: Cast iron.
      d. Disk Washer:
      e. Lock Washer:
      f. Bolts: 304SS
      g. Hinge Pin: 304SS
      h. Cotter Pin: 304SS
      i. Coating: Two Part Epoxy
      j. Pressure Rating: 175 psi minimum CWP.
      k. Seat Material: Suitable for potable-water service.

2.14 AIR RELEASE VALVES

A. Air Release Valves:
   1. Description: Resilient-seated eccentric.
      a. Standard: ANSI/AWWA C512-04
      b. Rating: NSF 61 for potable water use
      c. Body: Cast or Ductile Iron.
      d. Bolts: 304SS
      e. Float: Stainless Steel
      f. Internal Parts: Stainless Steel
      g. Coating: Two Part Epoxy

h. Pressure Rating: 150 psi minimum CWP.
i. Seat Material: Suitable for potable-water service.

2.15 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.16 TELESCOPING VALVESCORPORATION VALVES AND CURB VALVES

A. Manufacturers
1. The specification is based on the Series 310 Telescoping Valve as manufactured by Whipps, Inc. of Athol, Massachusetts.
2. Or Equal.

B. General
1. Telescoping valves shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
2. The valve shall utilize a low friction seal to mount to engage the slip tube and mount to the flange of the receiving pipe.
3. All welds shall be performed by welders with AWS certification.
4. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale.
5. Materials:

Components	Materials
Slip Tube and Bail	Stainless Steel, Type 304L, ASTM A-240
Stem	Stainless Steel, Type 304, ASTM A-276
Fasteners, Nuts and Bolts	Stainless Steel, Type 304, ASTM F-593 & 594

Seal	Urethane or Neoprene
Lift Nuts	Bronze ASTM B584
Pedestals and Wall Brackets	Stainless Steel, Type 304L, ASTM A-276
Operator Housing	Cast aluminum

C. Slip Tube and Bail

1. The slip tube shall be constructed of Schedule 10 minimum thickness stainless steel pipe. V-notched weirs, U-notched weirs, scum baffles and/or funnel tops shall be provided as shown on the Contract Drawings.
2. The bail shall be constructed of stainless steel and shall be bolted to the stem and welded to the slip tube.

D. Seal

1. The telescoping valve shall be provided with a self-adjusting seal system to restrict leakage between the slip tube and the receiving pipe.
   a. The seal shall be a one–piece molded urethane seal with an upper lip type seal and an integral companion flange.
   b. If a neoprene seal and separate companion flange is provided, the neoprene seal shall have a minimum thickness of 1/2-inch and the companion flange shall be stainless steel and shall have a minimum thickness of 3/8-inch.
   c. The companion flange shall be provided with a bolt pattern suitable for attachment to the flange on the receiving pipe.

E. Stem

1. A threaded operating stem shall be utilized to connect the operating mechanism to the bail which in turn is attached to the slip tube. On rising stem valves, the threaded portion shall engage the operating nut in the manual operator or motor actuator. On non-rising stem valves, the threaded portion shall engage the nut attached to the bail.
   a. The stem shall have a minimum diameter of 1-1/2 inches.
   b. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 90,000 psi. Stem extension pipes are acceptable.
   c. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
   d. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula.
   e. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
   f. The threaded portion of the stem shall have machine rolled double lead threads of the full Acme type with a 16 microinch finish or better.
   g. Stems of more than one section shall be joined by stainless steel couplings. The coupling shall be pinned and bolted to the stems.
   h. Stems, on manually operated valves, shall be provided with adjustable stop collars to prevent over travel.

F. Stem Guides

1. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
   a. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
   b. Adjustable in two directions.

G. Manual Operators

1. Unless otherwise shown on the Drawings, valves shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on a pedestal.
   a. The valve manufacturer shall select the proper gear ratio to ensure that the valve can be operated with no more than a 40 lb effort.
   b. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the valve.
   c. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
      1) Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
      2) Handwheel operators shall be equipped with roller bearings above and below the operating nut.
      3) Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
      4) The handwheel shall be removable and shall have a minimum diameter of 15 inches.
   d. Crank-operated gearboxes shall be fully enclosed and shall have a cast aluminum housing.
      1) Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
      2) Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
      3) Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
      4) Gears shall be steel with machined cut teeth designed for smooth operation.
      5) The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
      6) Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
      7) The crank shall be cast aluminum with a revolving nylon grip.
      8) The crank shall be removable.
   e. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
      1) The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36-in above the operating floor.
      2) Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
      3) Wall brackets shall be reinforced to withstand the maximum operating loads mentioned herein.

4) The design and detail of the brackets and anchor bolts shall be provided by the valve manufacturer and shall be approved by the ENGINEER. The valve manufacturer shall supply the bracket, anchor bolts and accessories as part of the valve assembly.

f. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers.
   1) The top of the stem cover shall be closed.
   2) The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
   3) Stem covers shall be complete with indicator markings to indicate valve position.

H. Anchor Bolts

1. Anchor bolts shall be provided by the valve manufacturer for mounting the pedestal and appurtenances.
   a. Quantity and location shall be determined by the valve manufacturer.
   b. If epoxy type anchor bolts are provided, the valve manufacturer shall provide the studs and nuts.
   c. Anchor bolts shall have a minimum diameter of 1/2-inch.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.2 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Use the following for valves in vaults and aboveground:
   a. Gate Valves, NPS 3 and Larger: cast iron, OS&Y rising stem, resilient seated.
   b. Check Valves: AWWA C508 UL/FMG, swing type.

3.3 PIPING INSTALLATION

A. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

B. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

D. Install PE pipe according to ASTM D 2774 and ASTM F 645.

E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

F. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration:

G. Install piping by drilling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, field LOK gaskets, thrust blocks, anchors, tie-rods and clamps, and other supports for a minimum of three pipe lengths or 60 feet before and after the change in direction.

3.4 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
6. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.

3.5 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.
7. Field Lok gaskets.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. MSS Valves: Install as component of connected piping system.

D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.7 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psi increments and inspect each joint between increments. Hold at test pressure for 2 hours; decrease to 0 psi. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.8 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground piping. Locate below finished grade, directly over piping.

3.9 DISINFECTION AND BACTERIOLOGICAL TESTING

A. Clean and disinfect potable water-distribution piping per “Section 330510 - Disinfection and Bacteriological Testing”.

B. Contractor to prepare and submit to Engineer reports of purging and disinfecting activities.

END OF SECTION

SECTION 331130
PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Ductile-iron pipe and fittings.
   2. Galvanized steel pipe and fittings.
   3. Stainless-steel piping
   4. PVC pipe and fittings.
   5. Piping joining materials.
   6. Encasement for piping.
   7. Transition fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For pipe and valves.

1.4 FIELD CONDITIONS

A. Interruption of Existing Systems: Do not interrupt systems to facilities occupied by Owner or others unless permitted under the following conditions:

   1. Notify Engineer no fewer than two days in advance of proposed interruption of service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to the Drawings for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

B. Appurtenances for Grooved-End, Ductile-Iron Pipe:
   1. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.

2. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:

    a. AWWA C606 for ductile-iron-pipe dimensions.
    b. Ferrous housing sections.
    c. EPDM-rubber gaskets suitable for hot and cold water.
    d. Bolts and nuts.
    e. Minimum Pressure Rating: 250 psi

2.3 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
1. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
2. Fittings for Grooved-End, Galvanized-Steel Pipe:

    a. AWWA C606 for steel-pipe dimensions.
    b. Ferrous housing sections.
    c. EPDM-rubber gaskets suitable for hot and cold water.
    d. Bolts and nuts.
    e. Minimum Pressure Rating 250 psi

2.4 STAINLESS-STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61 Annex G.

B. Stainless-Steel Pipe: ASTM A 312/A 312M, schedule 10.

C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

D. Appurtenances for Grooved-End, Stainless-Steel Pipe:

1. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
2. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:

    a. AWWA C606 for stainless-steel-pipe dimensions.
    b. Stainless-steel housing sections.
    c. Stainless-steel bolts and nuts.
    d. EPDM-rubber gaskets suitable for hot and cold water.
    e. Minimum Pressure Rating 250 psi

2.5 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.

B. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.6 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, stainless steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.7 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

C. Install piping level without pitch and plumb.

D. Install seismic restraints on piping.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping to permit valve servicing.

G. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install pressure gages on suction and discharge piping for each plumbing.

K. Install sleeves for piping penetrations of walls, ceilings, and floors.

L. Install sleeve seals for piping penetrations of concrete walls and slabs.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

E. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices.

B. Comply with requirements for pipe hanger, support products.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 10 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
3. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install supports for vertical piping every 10 feet.

F. Install hangers for piping with the following maximum horizontal spacing and minimum rod diameters:
   1. 10 feet with 7/8-inch rod.

G. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. 48 inches with 7/8-inch rod.

H. Install supports for vertical PVC piping every 48 inches.

I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

3.6 IDENTIFICATION

A. Label pressure piping with system operating pressure.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Piping Inspections:

      a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

         1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
         2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

      c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
      d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

   2. Piping Tests:

a. Fill piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psi above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.

4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 DISINFECTION AND BACTERIOLOGICAL TESTING

A. Clean and disinfect potable water-distribution piping per “Section 330510 - Disinfection and Bacteriological Testing”.

B. Contractor to prepare and submit to Engineer reports of purging and disinfecting activities.

C. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

D. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

E. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

3.11 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.

B. Use check valves to maintain correct direction of flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 331430
DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Work Specified- Centrifugally cast cement lined ductile iron pipe and fittings of the thickness class as specified in the pipe schedule or as shown on the Contract Drawings.

B. All Ductile Iron Pipe shall be NSF 61 certified.

1.2 REFERENCES

A. The latest version of all referenced standards shall apply.

B. Applicable Codes, Standards and Specifications
   1. American National Standards Institute (ANSI)
   2. American Water Works Association (AWWA)
   3. American Society for Testing and Materials (ASTM)

1.3 MATERIALS

A. Ductile Iron pipe and fittings shall comply with the following ANNI/AWWA standards:

1.	Ductile Iron Pipe	C151
2.	Fittings	C110
3.	Joints-Mechanical and Push-On	C111
4.	Joints-Flanged	C115
5.	Cement Lining	C104
6.	Polyethylene Encasement	C105

B. All piping shall be Class 52. Where pipe rating is reduced by threading, increase pipe weight to Class 53.

C. All pipe shall be manufactured in the United States and shall be new and of first class materials and construction.

D. All shipments of material shall be tested in accordance with the provisions for testing in the applicable standards.

1.4 SUBMITTALS

A. The manufacturer shall furnish sworn statements that all of the specified tests have been made and the results thereof comply with the requirements of the specified standards.

B. Pipe and joint details.

C. Layout drawings for Ductile Iron Pipe to be installed within structures showing the location including details of the support system, sleeves and appurtenances.

PART 2 - PRODUCTS

2.1 PIPE

A. General Requirements
1. All buried Ductile Iron pipe and fittings shall comply with the following standards:
a. ANSI/AWWA

1)	Ductile Iron Pipe	C151
2)	Fittings	C110
3)	Joints-Mechanical and Push-On	C111
4)	Joints-Flanged	C115
5)	Cement Lining	C104
6)	Polyethylene Encasement	C105

B. Buried Pipe
1. All buried pipeline scheduled to be ductile iron shall be ductile iron pipe, class 52, cement lined conforming to ANSI/AWWA C151/A21.51 specifications.

C. Interior Pipe
1. All interior gallery piping shall be ductile iron pipe, class 53 (where threaded) conforming to ANSI/AWWA C115/A21.15 specifications.
2. All interior gallery piping and fittings shall be exterior primed for painting.

D. Manufacturers for Push-on Joint Pipe

1.	American Pipe Product:	Fastite Joint
2.	U. S. Pipe Product:	Tyton Joint
3.	Griffin Pipe Product:	Super Bell-Tite Joint
4.	Clow Product:	Tyton Joint or Fastite Joint

E. Manufacturers for Mechanical Joint Pipe
1. American Pipe Product: Flex-Ring
2. U. S. Pipe Product: TR FLEX
3. Griffin Pipe Product: SNAP-LOK
4. Clow Product: Restrained Tyton or Restrained Fastite

2.2 CEMENT MORTAR LINING AND BITUMINOUS COATING

A. AWWA C104.

B. Thickness: Not less than 1/16 in.

C. Do not steam cure cement mortar lined pipe and fittings.

D. Apply bituminous seal coat over cement lining on inside of pipe. Coating shall be smooth, tough, tenacious, and impervious to water without any tendency to scale off and shall not be brittle.

2.3 POLYETHYLENE PIPE ENCASEMENT

A. Shall be 8 mil polywrap film manufactured of 100 % polyethylene material conforming to ASTM D 4976 Group 2 (Linear).

B. Shall be manufactured in accordance with ANSI/AWWA C105.

C. Pigmentation
   1. Natural when exposure to ultraviolet light, such as sun, is less than 48 hours.
   2. 2.0 to 2.5% well-dispersed carbon black with stabilizers when exposure to ultraviolet light is 2 to 10 days.

D. Material: Virgin polyethylene produced from Dupont Alathon or USI Petrothene resins.

E. Method of manufacture: Extruded tube form.

F. Closure Tape: Polyhen #900 or Scotchrap #50, 2" wide, plastic backed, adhesive tape.

G. Flat tube widths:

Nominal Pipe Sizes	Push-on Joint Flat Tube Width	Mechanical Flat Tube Width
6"	17"	20"
8"	21"	24"
10"	25"	27"
12"	29"	30"
14"	33"	34"
16"	37"	37"
18"	41"	41"
20"	45"	45"
24"	53"	53"

2.4 FITTINGS

A. All fittings shall conform to ANSI/AWWA C110/A21.10 specifications.

B. Buried Pipe Fittings
   1. All fittings for buried piping shall have compact ductile iron mechanical joints and shall conform to ANSI/AWWA C111/A21.11 specifications.
   2. All fittings for buried pipe shall be cement mortar lined with bituminous coating

2.5 PIPE INSULATION

A. Pipe Insulation shall be 2” thick Pittsburgh Corning FOAMGLASS insulation or approved equal.
   1. Shall include pit wrap with the pipe insulation.

B. Pipe insulation shall be installed only where as shown on the Contract Drawings and AOBE.

2.6 JOINTS

A. The type of joints for ductile iron pipe and fittings shall be as scheduled in the pipe schedule and/or as shown on the Contract Drawings.

2.7 VALVES

A. Buried Piping Valves
   1. For valve types refer to Sections 15010 and 15015.
   2. All valves shall open when turned counterclockwise unless otherwise noted.
   3. Valve box shall be slide type and “water” or “sewer” shall be cast on cover.
   4. All valves shall be manufactured in United States, and shall be Clow or approved equal.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Trench, backfill, and compact in accordance with Sections 312000.

B. Restrain piping and fittings at changes of alignment and at dead ends in accordance with pipe restraint details on Contract Drawings.

C. All ductile iron pipe and fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks or chains will not be permitted.

D. Adjust all hydrants, valve boxes, curb boxes, post blow-offs, buried post blow-off covers, manhole covers and other appropriate facilities to finished grade.

E. Cut polyethylene encasement in lengths 2 feet longer than the pipe section and place around the pipe.
   1. Install polyethylene encasement according DIPRA’s “Polyethylene Encasement Installation Guide”
   2. Overlap the joint with the polyethylene tube and secure in place with closure tape, after the pipe joint has been made.
   3. Fold tube over at the top and secure at quarter points along the pipe section.
   4. Remove and replace all damaged tubes.

3.2 JOINTS

A. Mechanical joints shall be assembled in accordance with the notes on Method of Installation, AWWA C111, Appendix A. All bolts shall be tightened by means of torque wrenches such that the follower shall be brought up evenly. If effective sealing is not obtained at the specified torques, the joint shall be disassembled, cleaned and reassembled.

B. Push-on joints shall be assembled using lubricant furnished by the manufacturer. The joint shall be made by guiding the plain end into the bell until contact is made with the gasket and exerting sufficient force to drive the pipe home until penetration is made to the depth recommended by the manufacturer.

C. Flanged joints shall be assembled with through bolts of the size required for the pipe being installed. Stud bolts shall be used only where shown or required. Connecting flanges shall be in proper alignment and no external force shall be required or used to bring them together.
   1. Flanges for flanged joints shall be drilled for 125 psi pressure unless otherwise specified.
      a. Flange bolts and nuts shall low alloy, corrosion resistant steel, except where other materials are called for in the pipe schedule.
      b. Gaskets for water and sewage piping shall be 1/8 inch thick of the ring type of cloth inserted rubber unless otherwise specified.
      c. Gaskets for other service shall be as specified.

D. Flange adapters as manufactured by EBAA Iron Inc. Series 2100 Megaflange Restrained Flange Adapter, or approved equal.

E. Bolted Couplings shall be Hymax Pipe Coupling or approved equal.

F. Grooved and shoulder type joints of the rigid design may be used in lieu of flanged joints with the prior acceptance of the Engineer and shall be in accordance with AWWA C606 and Table 5 for iron pipe.
   1. Bolts and nuts shall be cadmium plated steel.
   2. Details of supports, anchors and couplings shall be submitted for review.

G. Field Lock Gaskets shall be used to restraint the pipe per the details in the Contract Drawings.
   1. Shall be US Pipe Field Lok or approved equal.

3.3 COATING, PAINTING AND LINING

A. Coating, painting and lining shall be as follows unless otherwise specified in the pipe schedule:
   1. Pipe installed in the ground, in exposed exterior locations, in contact with water or inside structures but not scheduled for painting:
      a. Interior: Bituminous coating or standard thickness cement lining with sealcoat unless otherwise specified.
      b. Exterior: Bituminous coating.
   2. Pipe installed inside structures or scheduled for painting:
      a. Interior: Nothing
      b. Exterior: Pipes with bituminous coatings shall be coated with Inertol "Tar Stop", or Mobil Anti-Bleeding Sealer Aluminum 13-A-1 or equal, or sandblasted as specified, before additional coats described in the piping schedule to receive field painting, a shop prime coat of TNEMEC Series 69 Hi-Build Epoxyliner or equal may be supplied. If a shop prime is applied, the field prime specified in the Section entitled "Painting" shall be touch up only.

B. Polyethylene encasement shall be supplied and installed per DIPRA Guidelines on those sections of the pipe as indicated on the Plans or AOBE.

3.4 DISINFECTION AND BACTERIOLOGICAL TESTING

A. Clean and disinfect potable water-distribution piping per “Section 330510 - Disinfection and Bacteriological Testing”.

B. Contractor to prepare and submit to Engineer reports of purging and disinfecting activities.

3.5 HYDROSTATIC PRESSURE AND LEAKAGE TESTING

A. Perform testing per “Section 330500 Hydrostatic Pressure and Leakage Testing”.

END OF SECTION

END OF SECTION

SECTION 332600
PIPELINE INSTALLATION

PART 1. GENERAL

1.01 WORK SPECIFIED

Installation of all metallic and non-metallic pipe, conduit, fittings and specials of the type and quality as shown in the pipe schedule or on the Contract Drawings.

1.02 SUBMITTALS

Test reports, certifications, manufacturer's technical data, installation instructions, and shop drawings are required for each type of pipe to be installed.

Layout drawings are required for the pipeline to be installed within structures showing the location including the support system restraint, sleeves, and appurtenances.

PART 2. PRODUCTS

2.01 PIPE

A Materials for the piping, joints and fittings shall be as specified in the section for the type of pipe to be installed, shown in the pipe schedule or on the Contract Drawings.

B Pipe and appurtenances shall comply with the applicable standards for its type of material.

2.02 JOINTS

A. Type of joints shall be as scheduled in the pipe schedule or as shown or noted on the Contract Drawings.

B. Grooved and shoulder type joints of the rigid design may be used in lieu of flanged joints on the ductile iron or steel pipe with the prior acceptance of the ENGINEER.

2.03 INSPECTION

A Pipe and appurtenances shall be inspected by the CONTRACTOR in the presence of the ENGINEER on delivery and prior to installation for conformance with the standards and specifications.

B Materials not conforming to the standards and specifications shall not be stored on the site but removed at once and replaced with materials conforming to the specifications.

PART 3. EXECUTION

3.01 INSTALLATION - UNDERGROUND

A. General

1. Excavation and backfilling shall be in accordance with the applicable provisions of the Section entitled "Excavation and Backfill".
2. Blocking will not be permitted under pipe, except where the pipe is to be laid with concrete cradle or encasement.

3. No pipe shall be laid on a foundation in which frost exists, or at any time when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
4. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris or water.
5. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.
6. A 6" wide warning tape with continuous wording "CAUTION: BURIED PIPELINE BELOW" shall be installed not greater than 24 inches above all pipelines.
7. Waterline installation shall conform to AWWA C600-93.

B. Location and Grade
1. Pipelines and appurtenances shall be located as shown on the Contract Drawings or as directed and as established from the control survey in accordance with the Special Provisions.
2. The alignment and grades shall be determined and maintained by a method acceptable to the ENGINEER.
3. All water lines shall be buried a minimum of 5 feet from top of pipe.

C. Subgrade
1. The subgrade for pipelines shall be earth or special embedment as specified or directed and shall be prepared in accordance with the Section 02221.

D. Joints
1. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer's recommendations.

E. Wrapping of Pipe
1. Ductile iron pipe and fittings shall be wrapped in polyethylene per AWWA standards.

F. Embedment
1. Embedment shall be deposited and compacted in accordance with the Contract Drawings.

G Thrust Restraints
1. Pressure pipelines shall have thrust restraints in the form of mechanical restraints of the size and type specified or as required by the pressure and stability of the supporting surface.
2. Thrust restraints shall be installed at all changes in direction, changes in size, dead ends or other locations where shown.
3. Thrust restraints shall be in place, and when of concrete shall have developed the required strength, prior to testing of the pipeline.
4. Tie rods and nuts for thrust restraints shall be of high tensile steel and shall have a minimum yield strength of 70,000 psi.
5. Tie rods and nuts installed underground shall be coated with two coats of coal tar pitch preservative coating after installation.

3.02 INSTALLATION – EXPOSED/ABOVE GROUND

Exposed pipelines shall be carefully erected, neatly arranged, and run parallel to wall of structure.

Supports and anchors shall be adequate to support the pipe filled with water with a minimum safety factor of 5 and for test pressure specified.

Special supports shall be as specified in the Section for the type of pipe being installed.

All water pipelines and fittings shall be wrapped in closed-cell foam insulation and sealed to prevent condensation.

All exposed PVC piping shall be painted unless it is covered by insulation

3.03 CUTTING AND SPECIAL HANDLING

Field cuts of pipes shall be in accordance with the manufacturer's instructions.

Where a pipe requires special handling or installation it shall be in accordance with the Section for that type of pipe.

3.04 FLEXIBLE COUPLINGS

See Ductile Iron Pipe Specification.

3.05 WALL CASTINGS AND SLEEVES

All pipelines passing through walls, floors or slabs of structures shall be installed in a wall casting or sleeve. See Wall Castings and Sleeves Specification.

3.05 LEAKAGE TEST

All pipelines shall be tested for leakage in accordance with the Hydrostatic Pressure and Leakage Testing Specifications.

3.06 CHLORINATION

All pipelines designed to convey potable water shall be chlorinated in accordance with Ductile Iron Pipe Specification.

3.07 TRACER WIRE

All pipelines shall be installed with a tracer wire that is installed and terminated per manufacturer's recommendations.

1. Provide #12 AWG Copper Clad Steel, extra high strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.

2. All tracer wires must be interconnected in intersections with main lines and services, and hydrant leads.
3. All tracer wire terminations points must utilize a wire access box specifically manufactured for this purpose. Use Copperhead Industries Snake Pit tracer boxes.
4. Install termination points at intersections with water mains, services, hydrant leads, valve boxes, at 90 degree bends, and at 45 degree bends.

3.08 TRACER TAPE

All pipelines shall be buried with detectable tracer tape installed per manufacturer's recommendations. Tracer tape shall be Trumbull Industries or approved equal.

3.09 ADJUSTMENT OF UTILITY COVERS TO GRADE

The CONTRACTOR shall adjust the existing facilities such as water valves, valve boxes, and any other utility to grade, alignment, and slope of the finished roadway as determined by OWNER.

The CONTRACTOR shall support and protect all existing utilities within his work area. All manholes, frames and covers and water valve boxes of all existing utilities disturbed or exposed by construction shall be adjusted by the CONTRACTOR to one-quarter inch (1/4") below new finished grade elevations prior to placement of final pavement.

END OF SECTION

SECTION 335100
FRP Baffles

PART 1 - GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to install and ready for operation the FRP Baffles as shown on the Contract Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. The equipment covered in this section shall be a product of reputable, qualified, and successful manufacturers who are of proven ability and have experience in the production of such equipment.

B. The Drawings show a general arrangement of the major equipment components. There are additional miscellaneous works required for a full installation of a working system.

1.3 SUBMITTALS

A. Shop Drawings: Submit the following for approval:

1. Manufacturer's literature, illustrations, specifications and engineering data including dimensions, materials, sizes, weights, performance data, strength, and other information regarding the integrity, durability.

2. Setting drawings, templates and instructions for installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Bedford Reinforced Plastics, One Corporate Drive, Suite 106, Befored, PA 15522

B. Strongwell, 400 Commonwealth Ave., Bristol, Virginia, 24201

C. Or Equal.

2.2 DESIGN CRITERIA

A. Baffle panels shall contain a minimum of 55% glass fiber reinforcements (by weight).

B. All fasteners, anchors, and structural hardware shall be 316 stainless steel or FRP, with connections as shown on approved shop drawings.

C. FRP baffle panels shall be manufactured using the pultrusion process.

D. Resin shall be NSF 61 resin certified for potable water applications.

E. A minimum 7 mil. synthetic surface veil shall be the outermost layer covering the exterior surface.

F. Baffle walls shall be manufactured (and fabricated) in the U.S.A. in an ISO 9001 quality certified facility.

G. Panels shall meet the following minimum coupon properties:

1. Tensile Strength: 52,200 psi (ASTM D638)

2. Flexural Strength: 63,700 psi (ASTM D790)

3. Flexural Modulus: 1,910,000 psi (ASTM D790)

4. Water Absorption: 0.25% (ASTM D570)

5. IZOD Impact (Notched): 33.3 ft. lbs./in. (ASTM D256)

6. Compressive Strength: 52,100 psi (ASTM D695)

PART 3 - EXECUTION

3.1 DELIVERY, EXAMINATION, STORAGE, AND HANDLING

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Immediately after off-loading, contractor shall inspect the equipment and appurtenances for shipping damage or missing parts.

B. Store materials according to manufacturer instructions.

C. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

3.2 INSTALLATION

A. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. The Drawings show the general arrangement of the equipment and the major components. The Contractor is responsible for installing a fully operational complete unit. The Contractor is responsible for providing all necessary hardware, supports, hangers, braces, connections, etc. to make the unit fully functional and operational in accordance with the manufacturer's instructions.

3.3 WARRANTY

A. A written two-year standard warranty from the date of the successful equipment start-up shall be provided by the equipment supplier to guarantee that there shall be no defects in material, performance, or workmanship in any item supplied.

END OF SECTION

SECTION 335200
STATIC MIXERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to install and ready for operation the static mixer as shown on the Contract Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. The equipment covered in this section shall be a product of reputable, qualified, and successful manufacturers who are of proven ability and have experience in the production of such equipment.

B. The Drawings show a general arrangement of the major equipment components. There are additional miscellaneous works required for a full installation of a working system.

1.3 SUBMITTALS

A. Shop Drawings: Submit the following for approval:

1. Manufacturer's literature, illustrations, specifications and engineering data including dimensions, materials, sizes, weights, performance data, strength, and other information regarding the integrity, durability.

2. Setting drawings, templates and instructions for installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Koflo Corporation, 309 Cary Point Drive, Cary. IL 60013

B. Or Equal.

2.2 DESIGN CRITERIA

A. Quantity: two (2)

B. Design Model: 8-10S-3-3.2-AWD as manufactured by Koflo Corporation.

C. Design Model: 12-10S-3-3-AWD as manufactured by Koflo Corporation.

D. Design Requirements:

1. Pipe Diameters: 8 and 12 inch

2. Min Flow: 700 gpm

3. Max Flow: 1,400 gpm

4. Schedule 10S (0.148" Wall) 316/L Stainless Steel Housing

5. Three (3) Fixed Low Pressure Loss Design 316/L Stainless Steel Mixing Elements

6. 316/L Stainless Steel AWWA C228 Class SD Ring-Type Flanged Ends

PART 3 - EXECUTION

3.1 DELIVERY, EXAMINATION, STORAGE, AND HANDLING

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Immediately after off-loading, contractor shall inspect the equipment and appurtenances for shipping damage or missing parts.

B. Store materials according to manufacturer instructions.

C. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

3.2 INSTALLATION

A. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. The Drawings show the general arrangement of the equipment and the major components. The Contractor is responsible for installing a fully operational complete unit. The Contractor is responsible for providing all necessary hardware, supports, hangers, braces, connections, etc. to make the unit fully functional and operational in accordance with the manufacturer's instructions.

3.3 WARRANTY

A. A written two-year standard warranty from the date of the successful equipment start-up shall be provided by the equipment supplier to guarantee that there shall be no defects in material, performance, or workmanship in any item supplied.

END OF SECTION

END OF SECTION