SECTION 02800

WATER MAINS AND APPURTENANCES

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Statement of Intent

This policy outlines the minimum specifications for materials used in the installation and maintenance of *Water Mains and appurtenances* for the Bath Water District. Unless directly specified in this document, equipment and materials shall meet all applicable AWWA, ANSI, NSF, ASTM, and State and Federal Standards.

I. DUCTILE IRON PIPE:

1. Construction and Design:

   1.1. All ductile iron pipes shall be supplied in 20 foot lengths having Tyton® joints or equivalent as specified in AWWA/ANSI C111/A21.11 (for push on joints). Pipe shall be Zinc coated Class 52, designed for a 350 psi rated working pressure and for laying condition Type 4 (Type 4 - flat bottom trench, backfill consolidated to top of the pipe, and with up to eight feet of cover). Pipe shall be manufactured in full conformance with AWWA/ANSI C 1 5 1 /A21.51 standards.

      a. Special order pipe (mechanical joint or other) shall be furnished with standard gland, gaskets and Zinc coated Corten bolts and nuts as “standard accessories”.

1.2. The interior of the pipe shall be double cement lined and seal coated to twice the thickness (2 mils) specified in ANSI A21.4 - A21.5 and AWWA C 1 04 (for cement, mortar lining and seal coating).

1.3. The exterior of the pipe shall be Zinc and bituminous asphalt coated to 2-3 mils thick as specified in AWWA C 104 (for cement, mortar lining and seal coating) and shall be acceptable to the NSF for use in potable water. Field application of exterior coatings is prohibited. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent.

1.4. Pipe shall be furnished with gasket and gasket lubricants as "standard accessories".

1.5. Unless otherwise specified all ductile iron pipes must be manufactured in the United States or Canada.

1.6. Approved manufacturers are American™, U.S. Pipe™ and McWane™.

2. Installation:

2.1. Product Delivery, Storage and Handling

a. Pipe and accessories shall be delivered, stored and handled in a manner consistent with the written recommendations of pipe manufacturer. Care shall be taken not to damage materials during delivery, storage and handling. Dropping of materials will not be permitted. Suitable buffers to protect the material shall be provided.

b. Any materials found to be defective either before or after installation shall be removed from the job-site and replaced with sound materials.

c. Distribution of materials along the work area shall not be permitted, unless approved by the Owner. The Contractor shall not obstruct public or private areas such as but not limited to driveways, sidewalks, and walkways nor shall materials be placed on private property, unless written approval is obtained, before hand, from said property owner.

2.2. Push on Joint pipe shall be assembled and installed in strict accordance with the manufacturer's instructions as described below.

a. Completely, clean the bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.

b. After cleaning dirt or foreign material from the plain end, apply an approved lubricant in accordance with the pipe manufacturer's recommendations. The lubricant is supplied in sterile cans and every effort shall be made to keep it sterile.

c. Make sure that the plain edge is beveled, square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file, grinder or pipe saw to remove all sharp edges.

d. Push the plain end of the pipe into the bell of the pipe. Keep the joints straight while pushing. Make deflection after the joint is assembled. Small pipe can be pushed into the bell socket with a long bar. Large diameter pipe (12-inches and greater) requires additional power, such as a pipe jack, lever or backhoe. A piece of wood blocking should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe. Care should be taken to avoid "slamming" the pipe together potentially causing a joint failure.

2.3. Mechanical joint pipe shall be assembled and installed in strict accordance with the manufacturer's instructions as described below.

a. Wipe-clean the socket and plain end. The plain end, socket, and gasket shall be washed with a soap solution to improve gasket seating. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.

b. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recesses. Keep the joint straight during assembly. Make deflection after joint assembly but before tightening bolts.

c. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand-tighten the nuts.

d. Tighten the bolts to the normal range of bolt torque (75 to 90 feet lbs. for 4-inch to 24-inch diameter pipe), while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This can be accomplished by partially tightening the bottom bolt first, and then the top bolts. Repeat the process until all bolts are within the appropriate range of torque. Generally 3 to 4 repetitions are required.

2.4. For other types of pipe joints that may be specified for “specialty” type jobs, specific instructions will be given as needed.

2.5. Pipe cleanliness - Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other material shall be placed in the pipe at any time.

2.6. Pipe placement - As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be held in place via blocking behind the bell prior to back filling.

2.7. Direction of bells - It is common practice to lay pipe with the bells facing the direction in which work is progressing.

2.8. Provide a minimum of two serrated bronze silicon wedges at each joint.

2.9. Temporary pipe plugs - The open end of the pipe shall be closed with a watertight plug or by other means acceptable to the District. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe movement should the trench fill with water.

2.10. Pipe deflection - When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount shall not exceed 75 percent of the maximum allowable deflection as specified by the manufacturer. For example, for 12-inch DI push on pipe, the maximum allowable deflection is 21-inches for a 20-foot length of pipe. Therefore, the District will permit 75 percent of 21-inches (15-inches) maximum deflection per joint. Please keep in mind that deflections are cumulative in the horizontal and vertical plane.

2.11. Polyethylene encasement - Polyethylene encasement of DI pipe shall be done when specifically specified.

2.12. Pipe Bedding - AWWA Type 4 bedding conditions will be maintained during pipe installation. Trenches shall be flat bottomed, with 3-inches minimum of compacted sand or crushed stone beneath and to the top of the pipe. The BWD onsite inspector or their agent shall determine if the use of sand is suitable based on trench bottom conditions The

Cover material shall be gravel, sand, crusher dust or clean backfill material with a 2-inch sieve size to within 18" of the road surface. The final 18" shall be surface gravel. Total pipe cover will be 5'-6". If insulation is used total cover will be field determined.

2.13.

2.14. Flushing - All work shall be in accordance with this specification and AWWA C651-05. Where conflicts appear between these specifications and AWWA C651-05 the more stringent requirement shall apply.

a. Flushing, testing and chlorinating of the pipeline shall closely follow pipe laying work. As the pipeline is installed, it shall be tested approximately every 1,000 feet, or between line valves, whichever is less, as directed by the Bath Water District.

b. Upon completion of construction, fill mains with potable water, and remove all air from high spots and/or pockets.

c. All new and existing water mains that have been drained and cut into for making connections shall be thoroughly flushed prior to pressure, leakage testing and final chlorination. Flushing shall be accomplished by partially opening and closing valves, hydrants, and blow-off, several times under expected line pressures, with flow velocities of not less than 2.5 feet per second, in the main(s). The size and number of hydrants outlets to provide the required flow (at 40 psi residual pressure) is as follows:

MINIMUM REQUIRED FLOW AND OPENINGS TO FLUSH PIPELINES

Pipe Diameter (inches)	Minimum Flow To Produce 2.5 fps (gpm)	Size of Opening (inches)	Number
4	100	2½	1
6	220	2½	1
8	390	2½	1
10	610	2½	1
12	880	2½	1
16	1,565	2½	2

d. If less than a 40 psi residual is available in the main, with the size of hydrant opening shown above, then an additional hydrant outlet(s) will be required, as directed by the District.

e. The length of time for flushing, at or above the minimum allowable velocity, shall be computed to allow a minimum of three times the total volume of water stored in the main(s) to be flushed to waste. Flushing shall be done in the presence of the District.

f. The Contractor, with the assistance of the District, shall fill mains as slowly as practicable so as not to cause dirty water and serious pressure drops within the existing system. Vent air from the mains during the filling process and supply adequate manpower and make taps on the mains where directed.

g. Flush the completed main(s) to remove particulates. Following the filling and flushing of the main(s), and before chlorination, complete all hydrostatic testing to the satisfaction of the District.

2.15. Leakage Test

a. Leakage testing shall be conducted concurrently with the pressure test in accordance with the applicable AWWA standard.

b. Leakage Defined. Leakage shall be defined as the quantity of water that must be pumped into the new main, or any valved section thereof, to maintain pressure within ±5 psi of the specified test pressure, after the main(s) have been filled with water and all air has been expelled. Leakage shall be recorded to the nearest one-tenth of a gallon, by means of a calibrated test meter. If allowed by the Bath Water District, drawdown may be measured in a calibrated barrel. All records and charts shall become the property of the Bath Water District. The Contractor shall employ qualified personnel throughout the testing. Leakage shall not be measured by a drop in pressure over a period of time.

c. Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P\ 0.5)}{133{,}200}$$

where:

L = allowable gallons of leakage per hour

S = the length of pipe tested, in feet

D = the nominal pipe diameter in inches

P = the average test pressure during the test, in psi

The leakage formula is based on the allowable leakage of 11.65 gallons per day, per mile of pipe, per inch, (nominal) of pipe diameter, at a pressure of 150 psi. Allowable leakage at various pressures, for various pipe diameters are shown below.

ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE NOMINAL PIPE DIAMETER - (INCHES)

Average Test Pressure psi		*6*	*8*	10	*12*	*16*	*20*	*24*
250	0.71	0.95	1.19	1.42	1.90	2.37	2.85	
225	0.68	0.90	1.13	1.35	1.80	2.25	2.70	
200	0.64	0.85	1.06	1.28	1.70	2.12	2.55	
175	0.59	0.80	0.99	1.19	1.59	1.98	2.38	
150	0.55	0.74	0.92	1.10	1.47	1.84	2.21	
125	0.50	0.67	0.84	1.01	1.34	1.68	2.01	
100	0.45	0.60	0.75	0.90	1.20	1.50	1.80	

d. If the pipeline under test contains sections of various diameters, the allowable leakage, will be the sum of the computed leakage for each size.

e. When testing against closed metal seated valves, an additional leakage shall be allowed per closed valve, of 0.0078 gallons per hour, per inch of nominal valve diameter.

f. When hydrants are in the test section, the test shall be made against the closed hydrant(s).

g. Acceptance shall be determined on the basis of allowable leakage. If any test of pipe discloses leakage greater than that specified, the Contractor shall locate and make repairs as necessary until the leakage is within the specified allowance.

h. All visible leaks are to be repaired regardless of the amount of leakage.

i. All water mains shall be pressure and leakage tested in the presence of the District, in order to qualify for acceptance.

2.16. Chlorination - The method of chlorination shall be the "Continuous Feed Method" as described hereinafter, and as approved by the Bath Water District. The Continuous Feed Method consists of the following steps:

a. The Contractor shall consult with the Bath Water District to identify acceptable location(s) for discharging the heavily chlorinated water, which will result from the chlorination procedures. Final acceptance of the water main(s) shall be based on successful (absence - negative) results of bacteria tests, which shall be done on samples taken from the main(s) following chlorination and final flushing. Locations of samples shall be as directed by the Bath Water District.

- A pumping unit or proportionate feeder suitable for delivering a hypochlorite solution to the isolated main shall be provided. The unit used shall prevent chlorine solution from flowing back into the existing system.

- Chlorine solution for disinfecting water mains and appurtenances shall be made from either liquid sodium hypochlorite, or solid calcium hypochlorite, which shall conform, to the latest AWWA B300 Standard for Hypochlorite.

b. Fill the main(s) with chlorinated potable water, having an initial concentration of 25 mg/l free chlorine residual. After a 24-hour period, there shall be a minimum of 10 mg/l free chlorine residual in the main(s).

c. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate, into the new main(s). In the absence of a meter, the rate may be approximated by methods such as a pitot gauge in the discharge or measuring the time to fill a container of low volume.

d. At a point not more than 10 feet downstream from main(s), water entering the new main shall receive a dose of hypochlorite solution fed at a constant rate such that the water in the main(s) will have not less than 25 mg/l free available chlorine. To assure that this concentration is achieved, the contractor shall measure chlorine concentration at regular intervals along the main(s), using appropriate chlorine test kits, or as otherwise described in the current edition of AWWA Ml 2- Simplified Procedures for Water Examination.

e. The amount of chlorine required to obtain a concentration of 25 mg/l per I 00 feet of various diameter pipes is as follows.

CHLORINE REQUIRED TO OBTAIN A CONCENTRATION OF 25 PPM PER 100 FEET OF PIPE.

Pipe Dia. (ins.)	SODIUM HYPOCHLORITE - GALLONS				CALCIUM HYPOCHLORITE
	5 percent Avail. Chlorine	10 percent Avail Chlorine	12-1/2 percent Avail. Chlorine	15 percent Avail. Chlorine	65 percent Avail. Chlorine
4	0.03	0.02	0.02	0.01	0.32 Ounces
6	0.08	0.04	0.03	0.03	0.75 Ounces
8	0.13	0.07	1.06	0.06	1.30 Ounces
12	0.28	0.15	0.12	0.10	2.95 Ounces
16	0.50	0.25	0.22	0.17	5.30 Ounces

f. The above quantities are to be added to a sufficient quantity of water, dissolved, and mixed. The entire solution shall be injected into the main as specified.

g. The quantities shown are based on concentrations of available Chlorine by volume. Extended or improper storage may have caused a loss of available chlorine.

h. For concentrations of 50 ppm, double the quantities listed.

i. During the application of chlorine, valves shall be closed to prevent strong Chlorine solution in the new main(s) from flowing into the existing system. Chlorine application shall continue until the entire main(s) is filled with water having 25 mg/l of free available chlorine. The chlorinated water shall be retained in the main(s) for at least 24 hours, during which time all valves and hydrants in the section(s) being treated shall be operated, in order to disinfect the appurtenances. At the end of this 24 hour period, all portions of the main(s) and appurtenances being tested shall have a free available chlorine residual of at least 10 mg/l. If less than less 10 mg/l free available chlorine is measured, the main shall be re-flushed and the entire disinfection process repeated.

j. Hypochlorite solutions shall be applied to the water main(s) with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strengths as to safely withstand corrosion caused by the concentrated chlorine solutions, and also the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

2.17. Final Flushing - After the specified retention period, the heavily chlorinated water shall be flushed from the main until chlorine measurements show the concentration in water leaving the main is no higher than that generally prevailing in the system.

a. Arrangements shall be made with the District to flush the mains of chlorinated water. Great care shall be exercised in the selection of the rate of flow and the discharge points, in order to minimize complaints, and damage to public or private property.

b. The environment to which the chlorinated water is to be discharged shall be inspected. If chlorinated discharge will cause damage to the environment, a solution of sodium thiosulfate shall be applied to the water that will thoroughly neutralize the chlorine residual. The contractor should make sure that such discharges meet all applicable state, federal, and local regulation for the disposal of heavily chlorinated water.

2.18. Bacteriological Tests

a. Standard Conditions. After final flushing and before the water main is placed in service, water samples shall be collected twice at each sample point designated by the District and tested for bacteriological quality in accordance with Standard Methods. Water samples shall show the absence of coliform organisms and background bacteria. A standard plate count may be required at the option of the District. Water samples shall be taken at the locations directed by the District.

b. Special Conditions. If, during construction, trench water has entered the main, or if in the opinion of the District excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified as to the location. Samples shall be taken at the location directed by the Owner.

c. Sampling Procedure. Samples for bacteriological analysis shall be collected, in the presence of the District, in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in collection of samples. A corporation cock shall be installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed. The Contractor shall sample twice at each location designated by the District.

d. The Contractor shall deliver samples to a laboratory approved by the Department of Human Services for bacterial analysis. The Contractor shall pay for the cost of analysis. Only after each consecutive sample is approved shall the mains be incorporated into the water system. In the event, that positive reports of contamination are received, the mains shall be flushed as many times as may be necessary to obtain approved (absence/negative) results.

2.19. Re-Chlorination - If the initial chlorination fails to produce satisfactory bacteriological results the main(s) shall be re-flushed and re-sampled. If check samples show the presence of coliform organisms, then the main shall be re-chlorinated by the continuous feed method of chlorination, until satisfactory results are obtained. High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, the Contractor shall sample water entering the new main.

2.20. Chlorination Procedures when cutting into or Repairing Existing Mains - The following procedures apply when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main maybe returned to service prior to completion of bacteriological testing, in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains are full of water under pressure present little danger of contamination and require no disinfection.

a. Trench Treatment. When an old main is opened, either by accident or on purpose, the excavation will likely be wet and may be contaminated from nearby sources of sewage or other pollution. Liberal quantities of hypochlorite tablets shall be applied to open trench areas to lessen the danger from pollution.

b. Swabbing with Hypochlorite Solution. The interior of all pipe and fittings used in making a repair (particularly couplings and sleeves) shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.

c. Flushing. If valve and hydrant locations permit thorough flushing toward the work location from both directions, it shall be done. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

d. Slug Chlorination. Where practical in addition to the procedures above, a section of main in which the break is located shall be isolated. All service connections shall be shut off, and the section flushed and chlorinated by the slug method and the dose may be increased to as much as 300 mg/L, and the contact time reduced to as little as one-hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.

e. Bacteriological samples shall be taken after repairs. If the direction of flow is unknown, samples shall be taken on each side of the main break. If positive samples are recorded, daily sampling shall be continued until two consecutive negative samples are recorded. Positive samples shall be evaluated by the Engineer for corrective action.

II. FITTINGS (BENDS, REDUCERS, OFF-SETS, TEES, AND SLEEVES):

1. Construction and Design:

1.1. Fittings shall be compact ductile iron Class 350 with mechanical joint ends. Fittings shall conform to ANSI Specifications A21.10, A21.4, A21.53, and A21.11C, and AWWA C110, C111, C153, and C104 for applicable fittings in size 4-inch through 24-inch. All fittings shall be of standard grade 70-50-05 ductile iron construction with the following minimum characteristics

a. 70,000 psi minimum tensile strength

b. 50,000 psi minimum yield strength

c. 5 percent minimum elongation

1.2. Push on fittings will not be accepted without prior approval from the Bath Water District.

1.3. Mechanical joint nuts shall be Zinc Coated Corten, high strength, low alloy steel per ANSI A2 1.1 1.

1.4. Cast iron fittings are <u>not</u> permitted.

1.5. Standard and flanged joint fittings will not be accepted without prior approval. Accepted fittings in these categories will meet the following minimum specifications:

a. Mechanical joint standard fittings shall be ductile iron Class 350 in accordance with ANSI Specifications A21.10, A21.4, A21.53, and A21.11C, and AWWA C110, C111, C153, and C104 for applicable fittings in size 4-inch through 24-inch.

b. Flanged joint fittings shall be ductile iron Class 250 in accordance with ANSI Specifications A21.10, A21.4, A21.53, and A21.1 IC, and AWWA C110, C111, C153, and C104 for applicable fittings in size 4-inch through 24-inch.

1.6. All fittings shall be cement lined and coated inside with a minimum 4 mils film thickness. The outside shall be bituminous coated with a minimum 4 mils dry film thickness. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the fitting.

1.7. Fittings must be Clow™, Tyler™ or Griffin™**,** or approved equal.

1.8. All fittings will be supplied with standard accessories unless otherwise specified. Mechanical joint accessories shall be ductile iron glands, which conform to A536. All sizes shall be underwriters laboratory listed 877P. Mechanical joints shall also include Grip Rings™ accessory packs. Glands shall be painted yellow.

1.9. Unless otherwise specified all ductile iron pipe fittings must be manufactured in the United States or Canada.

2. Installation:

2.1. All fittings shall be inspected prior to installation to ensure the gasket seats are free of excess coatings. Excess coating, if present, shall be manually removed so as to ensure proper seal of the gasket, however, all bare metallic surfaces created as a result of removing the excess coating shall be recoated with similar material to prohibit corrosion.

2.2. The fittings shall be placed, supported and installed in strict accordance with the manufacturer's instructions and as directed by the Bath Water District. All bolted joints shall be torqued as follows:

a. Mechanical Joints 4-inch to 24-inch diameter pipe:

- 3/4-inch bolts - torque = 75 to 90 feet lbs.

b. Flanged Joint 4-inch to 24-inch diameter pipe:

- 5/8-inch bolts - torque = 40 to 60 feet lbs.
- 3/4-inch bolts - torque = 60 to 90 feet lbs.
- 7/8-inch bolts - torque = 40 to 60 feet lbs.
- 1-inch bolts - torque = 40 to 60 feet lbs.
- 1 ¼-inch bolts - torque = 40 to 60 feet lbs.

2.3. Procedure for installing bolts -

a. Insert bolts and make finger tight.

b. Tighten diametrically opposite nuts progressively and uniformly around joint with properly calibrated torque wrench to the valves as specified above.

c. Coat all bolt threads for flanged connections with “never-seize” or an approved equal product.

III. RESTRAINED JOINTS:

1. Construction and Design:

1.1. Restrained joints shall be used at all pipe joints, fittings, valves, etc. Mechanical joint restraints shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the pipe shall be maintained after burial.

1.2. Mechanical joint nuts and bolts shall be Zinc Coated Corten™, made of high strength, low alloy steel and conform to AWWA C-111, 11-7.5 and ANSI A21.11. Mechanical joint nuts and bolts shall be composed of a maximum of 20 percent carbon, 1.25 percent magnesium, 0.05 percent sulfur, 0.25 percent nickel, 0.20 percent copper and a minimum combined 1.25 percent of nickel, copper and chromium. The mechanical joint nuts and bolts shall also have minimum yield strength of 45,000 psi and elongation in 2-inch increments of 20 percent.

1.3. Mechanical Joint gaskets shall comply with AWWA C-111 and ANSI A21.11 for SBR gaskets. Glands shall be manufactured of ductile iron, beat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and "T" head bolts conforming to ANSI/AWWA A21.53 and ANSI/AWWA C I 53/A21.53 of latest revision.

1.4. The mechanical joint devices shall have a working pressure of at least 350 psi, with a minimum safety factor of 2:1.

1.5. The mechanical restrained joints shall be Grip-Ring™, manufactured by Romac Industries.

1.6. Unless otherwise specified all restrained joints must be manufactured in the United States or Canada.

2. Installation:

2.1. All restrained joints shall be thoroughly inspected for cracks or similar physical defects prior to their installation.

2.2. All joints are to be restrained for a minimum distance of 18 feet beyond each side of a fitting or valve including the joints at the fitting or valve, or as otherwise show on the construction plans. Restrained lengths beyond the minimum are to be based on a 200 psi working pressure, 5-foot depth of cover, and actual soil conditions encountered.

2.3. The restrained joints shall be installed in strict accordance with the manufacturer's instructions and as directed by the Bath Water District. All bolted joints shall be torqued as follows:

a. Mechanical joints 4-inch to 24-inch diameter pipe:

- 3/4-inch bolts - torque = 75 to 90 feet lbs.

b. Flanged joint 4-inch to 24-inch diameter pipe:

- 5/8-inch bolts - torque = 40 to 60 feet lbs.
- 3/4-inch bolts - torque = 60 to 90 feet lbs.
- 7/8-inch bolts - torque = 40 to 60 feet lbs.
- 1-inch bolts - torque = 40 to 60 feet lbs.
- 1 ¼-inch bolts - torque = 40 to 60 feet lbs.

2.4. Procedure for installing bolts -

a. Insert bolts and make finger tight.

b. Tighten diametrically opposite nuts progressively and uniformly around joint with properly calibrated torque wrench to the valves as specified above.

c. Coat all bolt threads for flanged connections with “never-seize” or an approved equal product.

IV. GATE VALVES:

1. Construction and Design:

1.1. Gate valves shall be ductile iron body, bronze mounted, resilient wedge gate with two inch operating nut and mechanical joint ends. Minimum body thickness and design must meet or exceed AWWA standard C-153. Gate valves shall conform to AWWA C500.

1.2. Exterior nuts and bolts shall be 5/8-inch diameter or greater and shall be type 18-8, 304 stainless steel, installed by the manufacturer. Exterior nuts and bolts shall meet ASTM F593, GP 1.

1.3. Wedges shall be constructed of ductile iron, fully encapsulated in synthetic rubber per AWWA C-509. Wedge rubber shall be molded in place and bonded to the ductile iron portions. Under no circumstances shall rubber be mechanically attached with screws or other fastening devices. Wedges shall seat against seating surface arranged symmetrically about the center line of the operating stem so that seating is equally effective regardless of direction of pressure imbalance across the wedge.

1.4. All seating surfaces shall be inclined a minimum angle of 32 degrees from vertical, to eliminate abrasive wear of rubber sealing surfaces. Waterways shall be smooth and shall have no depressions or cavities in the seat area where foreign materials can lodge and prevent closure or sealing.

1.5. All valves shall be provided with three “O” rings to seal the stem. The design of the valve shall be such that the stem seals, above the thrust collar, can be fitted can be fitted with new “O” rings while the valve is under full working pressure in a fully open position.

1.6. Stems shall be constructed from rolled stainless steel, Type 304 or higher. Bronze stems may be substituted with the permission of the Bath Water District.

1.7. Valve interiors and exteriors shall have a 100 percent solids thermoset or fusion bonded epoxy protective coating throughout, holiday-free in the waterway, which shall meet all requirements of AWWA C550. The coatings shall be a product approved by NSF for use in potable water and shall be so listed in the most current NSF summary of approved products ANSI/NSF Standard 61. The valve manufacturer, under controlled factory conditions shall apply the coating, and under no circumstances shall a field application be permitted.

1.8. All valves must be open left, close right and have a full ten-year warranty.

1.9. Unless otherwise specified all gate valves must be manufactured in the United States or Canada.

1.10. Gate valves shall be Clow , American Flow Control™ Model 2500, or pre approved equal manufacturer.

2. Installation

2.1. Blocking, set on thoroughly compacted soil, shall be used to support the valve body during installation.

2.2. All joint bolts shall be torqued using a calibrated torque wrench in accordance with the manufacturer's specifications.

2.3. Care should be taken to ensure that the fusion-bonded epoxy coating is not damaged. Any damaged areas shall be repaired.

V. VALVE BOXES:

1. Construction and Design:

1.1. Valve boxes shall be cast iron, tar coated, two piece, sliding type adjustable with cast iron covers. Valve boxes shall have a top flange. The bell end of the lower sections shall in all cases be sufficiently large to fit over the stuffing boxes of the valves. The smallest inside diameter of the shaft shall not be less than 5¼-inches. Unless specified directly, the top section will be a 26-inch and the bottom will be a 36-inch bell.

1.2. The upper section shall have a flange sufficiently strong to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve. Each valve box, including cover shall weight at least 100 pounds.

1.3. The cover shall be heavy 2-inch drop type, non-tilting cast iron unit that is recessed in the top to prevent breakage. The cover shall be provided with two pick holes for easy removal. The word "WATER" shall be cast into the cover

1.4. All valves box components shall be generously coated with a corrosion resistant bituminous coating.

1.5. Unless otherwise specified all valve boxes must be manufactured in the United States or Canada.

2. Installation:

2.1. Valve boxes shall be installed concentric to the operating nut and shall be centered in the bell end. Boxes shall be plumb with the vertical plane.

2.2. 6-inch of crushed stone shall be placed around the bell base of the valve box.

2.3. The bell base section shall be placed on blocking in such a way that no additional loading is transferred to the valve.

2.4. Additional extensions for bury depths greater than 6 feet shall be specified.

VI. SERVICE BOXES:

1. Construction and Design:

1.1. Service boxes shall be Erie™ style with a plug type cover. Service boxes shall be constructed of 1.0 inch I.D. iron pipe with the top having 1.0 inch N.P.T. threads for a screw on cover. The box will be supplied in a 5-foot to 6-foot bury with a slide type riser.

1.2. All boxes shall be heavily coated with bituminous paint.

1.3. Service Box Cover

a. The cover shall be cast iron construction with N.P.T. female threads to accept the service box and will have a solid, lead-free brass plug with a pentagon operating head and a 1-inch course "rope" thread.

1.4. Service Box Rod -

a. A circular 1/2-inch (or larger) by 36-inch, 304 stainless steel service box rod shall be required. The design of the rod must have a yoke that is an integral part of the rod and be self aligning.

b. The curb stop cotter pin shall be lead-free brass to minimize the danger of damaging the curb stop.

c. The rod "wrench-flat" shall have a minimum thickness of 1/4-inch tapered to 1/16-inch and width of 5/8-inch or 1/2-inch.

1.5. Service Box Foot Piece -

a. The standard foot piece shall be heavy-duty cast iron design. The foot piece shall be designed to have an arch to fit over either 3/4-inch or a 2-inch ball valve curb stops, depending on the installation.

1.6. Unless otherwise specified all service boxes must be manufactured in the United States or Canada.

2. Installation:

2.1. Service box foot pieces shall be placed on the same blocking that supports the Curb Stop (see IX. Curb Stops, Section B, and Subsection i).

2.2. Service box tops shall be set 1-inch below finished grade, magnetized, and painted fluorescent blue prior to burial.

2.3. A minimum of two lateral "ties" shall be taken from permanent fixtures such as house corners, fire hydrants, etc., to the box top for the purpose of future location. These ties shall be recorded in sketch form and compared with the measurements taken from the corresponding curb stop.

VII. HYDRANTS:

1. Construction and Design:

1.1. Hydrants shall be center stem type and conform to AWWA C-502 standard for dry barrel hydrants. Hydrants shall be compression type with the main valve opening with the water pressure and have a rising stem to positively indicate open or closed position.

a. The barrel shall be made of ductile iron, designed for 5-foot to 7-foot bury with a minimum inside diameter of 7 1/4-inches.

b. The hydrant shall have a main valve opening of a minimum of 5 1/4-inch.

1.2. The two piece-operating nut shall be ductile iron or bronze and be pentagon shaped with standard dimensions for durability and low maintenance.

1.3. Hydrants shall be the traffic model design, with the following breakaway features:

a. Segmented cast iron flanges with frangible (breakable) bolts.

b. Break type rod couplings set equal to, or below, the line of the top flange of the lower barrel.

c. An NSF/AWWA approved rubber gasket should be provided between the two barrels.

1.4. A travel stop nut shall be used to provide a positive limit to the travel of the main operating rod. The all-bronze drain plunger shall be positively operated by the main operating rod.

1.5. The hydrant shall be supplied with one 4½-inch National Standard Thread (NST) Pumper and two 2½-inch NST hose connections.

a. Hose connection ports shall be supplied with chains and with the same size nut as the main operating nut.

b. The nozzle section shall be capable of 360 degree rotation by loosening four bolts.

c. Nozzles shall be mechanically attached with a ductile iron retainer and sealed with an 0-Ring.

1.6. The hydrant shall be open-left.

1.7. Hydrant extensions shall be such that the location of the hydrant valve and scat remain in, or at, the shoe. The hydrant must be designed so that it can be extended from both the bottom and the top.

1.8. The hydrant shoe or base shall have the following:

a. A 6-inch mechanical joint inlet.

b. A 5 1/4-inch valve opening with non-draining bronze seat that is permanently plugged.

c. Valve seat and sub-seat arrangement shall be bronze to bronze.

d. Blocking area on bottom of the shoe and on back of the shoe shall meet minimum AWWA requirements.

e. Exterior nuts and bolts shall be 5/8-inch diameter or greater and shall be type 18-8, 304 stainless steel, installed by the manufacturer. Exterior nuts and bolts shall meet ASTM F593, GP1

1.9. Hydrants shall be Clow-Eddy Model F-2641, or approved equal.

1.10. All above ground sections of the hydrants shall come from the manufacturer primed and painted with, at least, two coats of traffic yellow rust inhibitive paint.

1.11. Unless otherwise specified all hydrants must be manufactured in the United States or Canada.

VIII. CORPORATION STOP:

1. Construction and Design:

1.1. Corporation Stops shall be of the 1/4 turn ball valve type. Brass shall be lead-free. Materials shall meet or exceed the latest revision of AWWA Standard C-800.

1.1. Blocking, set on thoroughly compacted soil, shall be used to support the valve body during installation.

1.2. All joint bolts shall be torqued using a calibrated torque wrench in accordance with the manufacturer's specifications.

1.3. Care should be taken to ensure that the fusion-bonded epoxy coating is not damaged. Any damaged areas shall be repaired.

1.2. For buried butterfly valves the operating mechanism will be thoroughly greased and exercised before backfilling. Teflon™ (TFE) coated, lead-free brass and provide a full port opening.

1.3. The inlet shall have AWWA (CC) taper threads.

1.4. Outlet connections shall be compression pack joints (CPPJ), for either a compression pack joint (PJ) for copper or CTS plastic on the outlet. CPPJ corporations shall be designed such that the PJ nut "shoulders" tight against the corporation valve body.

1.5. The valve stem shall be provided with double Nitrile (Buna-N) 0 ring seals, 70 Durometer, to insure a permanent water tight seal. The ball seats shall also be molded Buna-N rubber. Seals shall be put into place with an NSF approved epoxy.

1.6. Rated working pressure shall be 300 psi or greater.

1.7. Acceptable manufacturer's are McDonald, Mueller (300 B-25008 and B-25000) and Ford (F1000), or approved equivalent equal.

1.8. Unless otherwise specified all corporation stops must be manufactured in the United States or Canada.

2. Installation:

2.1. The Bath Water District only permits 3/4-inch and 1-inch diameter direct tapped corporation into cast iron and ductile iron mains. Larger diameter direct tapped corporations will be evaluated on an individual, case by case, basis.

2.2. Corporation taps shall be located at 10:00 and 2:00 o'clock on the main.

2.3. Corporations shall be "screwed" into ductile iron pipe water mains such that no more than 4 threads are exposed.

2.4. A minimum of two (2) lateral "ties" shall be taken from permanent fixtures such as house comers, fire hydrants, etc., to the corporation for the purpose of future location. These ties shall be recorded in sketch form and submitted to the Bath Water District prior to final acceptance.

IX. CURB STOPS:

1. Construction and Design:

1.1. Curb Stops shall be of the 1/4 turn ball valve type in 3/4-inch to 2-inch body sizes and have full depth female iron pipe (FEIP) thread ends. Brass shall be lead-free. Materials shall meet or exceed the latest revision of AWWA Standard C-800.

1.2. Outlet connections shall be compression pack joints (CPPJ), for either a compression pack joint (PJ) for copper or CTS plastic on the outlet. CPPJ corporations shall be designed such that the PJ nut "shoulders" tight against the corporation valve body.

1.3. The ball mechanism shall be constructed of Teflon™ (TFE) coated, lead-free brass and provide a full port opening.

1.4. The valve stem shall be provided with double Nitrile (Buna-N) 0 ring seals, 70 Durometer or greater, to insure a permanent water tight seal. The ball seats shall also be molded Buna-N rubber. Seals shall be put into place with an NSF approved epoxy. The operating cap/stem shall be held in place with a lead-free brass retaining nut threaded on to the stem and epoxied.

1.5. Rated working pressure shall be 300 psi or greater.

1.6. The curb stop shall not have a drain (waste) hole.

1.7. Acceptable manufacturers are McDonald, Mueller, Ford, or approved equivalent equals.

1.8. Unless otherwise specified all curb stops must be manufactured in the United States or Canada.

2. Installation:

2.1. Curb stop ball valves shall be firmly supported on blocking (wooden, granite, cement or other compatible material), set plumb and positioned such that the operator key is in the vertical plane prior to backfilling.

2.2. All curb stop ball valves shall be installed with Bath Water District approved services boxes (see Service Box Specifications) and accessories, unless otherwise specified.

2.3. Prior to backfilling, the curb stop ball valve shall be placed under the applicable AWWA/ANSI static head pressure test unless otherwise waived by the Bath Water District.

2.4. Bath Water District personnel will inspect all private line connections to Bath Water District facilities.

X. COPPER SERVICE LINE TUBING:

1. Construction and Design:

1.1. Underground service line shall be seamless Type K malleable copper tubing that conforms to ASTM Standard B-88 and the latest revision of AWWA Standard C-800.

2. Installation:

2.1. Extreme care shall be taken during installation to ensure that copper tubing is not crimped, gouged or otherwise detrimentally damaged.

2.2. The use of couplings shall be minimized by using the longest continuous coils available for the specific job. Under no circumstances are compression fittings to be used in the roadway portion of the installation.

2.3. Approved compression style joints shall be used for all pipe connections. Under no circumstances will soldering of underground copper tubing joints be permitted.

2.4. Copper tubing ends shall be de-burred and re-rounded prior to installing fittings to ensure strong, water tight connections.

2.5. Bedding material shall be sand, gravel with a maximum 2-inch nominal diameter stone size or backfill material of similar quality.

2.6. The Bath Water District will determine line size.

XI. DUCTILE IRON COUPLINGS (SLEEVES)

1. Construction and Design:

1.1. Mechanical joint style straight and transition type couplings shall be constructed entirely of ductile iron meeting or exceeding ASTM Standard A536-80, Grade 65-45-12.

1.2. Center sleeve shall be grade 65-45-12 ductile iron meeting or exceeding ASTM Standard A536-80. All areas of the center ring shall receive a heavy shop coat of primer and epoxy paint at the factory.

1.3. End ring shall be grade 68-45-12 ductile iron meeting or exceeding ASTM Standard A536-80. End rings shall be ASTM color coded as to the outside diameter range of pipe.

1.4. Gaskets shall be virgin SBR compound for water service meeting or exceed ASTM Standard D2000 3 BA715. Gaskets shall be embossed with size for easy identification.

1.5. Bolts and heavy hex nuts shall be high strength Zinc coated Corten or Type 18-8, 304 Stainless Steel.

1.6. Unless otherwise specified all couplings must be manufactured in the United States or Canada.

2. Installation:

2.1. Couplings shall be installed in strict accordance with the manufacturer's instructions. All nuts shall be tightened in an alternating star pattern with a properly calibrated torque wrench, according to manufacturer's specifications.

2.2. Offset marks shall be made on coupling pipe at all times to allow for the coupling to be centered over the joint between the two sections of main being coupled.

2.3. A minimum of two linear field ties shall be taken by the contractor so as to provide an accurate location of the coupling(s) once buried.

XII. TAPPING SLEEVES:

1. Construction and Design:

1.1. Tapping sleeves shall be mechanical joint, split sleeve with outlet flange conforming to AWWA C-1 10 Sect. 10-14 with drilling recessed for tapping valve or heavy gauge 304 Stainless Steel per AWWA c228-08. ANSI class 125 and 150 drillings.

1.2. The sleeve must be of ductile iron or heavy gauge stainless steel construction and include a 1/4-inch female iron pipe threaded test plug so that sleeve and valve can be pressure tested before the tap is made.

1.3. Sleeves up to 10-inches by 10-inches shall be rated for a minimum working pressure of 200 psi.

1.4. For mechanical tapping sleeves the side rubber gaskets shall be rectangular in cross section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match MJ end gaskets. Stainless tapping sleeves gaskets shall be Virgin (SBR) or equal

1.5. MJ Sleeves shall be furnished with standard accessories including: glands, gaskets, Zinc coated Corten bolts and nuts. All flange bolts shall be 316 stainless steel.

1.6. Interior and exterior to be bituminous coated with a minimum 4 mils dry film thickness.

1.7. For resilient seat tapping wedge valves, in order to avoid damage to the valve sealing surface, use recommended cutters with following maximum dimensions:

a.	Valve Size:	4-inch	6-inch	8-inch	10-inch
b.	Cutter Size:	3.75-inch	5.75-inch	7.75-inch	9.75-inch

1.8. Unless otherwise specified all tapping sleeves must be manufactured in the United States or Canada.

2. Installation:

2.1. Mechanical joint tapping sleeves and Stainless tapping sleeves shall be installed in strict accordance with the manufacturer's instructions.

2.2. Once installed, the tapping sleeve shall be pressure tested prior to making the tap.

2.3. The tapping sleeve shall be installed such that the flanged face of the sleeve shall be plumb with the vertical plane. The contractor shall use a level to check for plumb and make adjustments as necessary.

XIII. TAPPING SLEEVE VALVES:

1. Construction and Design:

1.1. Mechanical joint tapping sleeve and Stainless Steel tapping sleeve valves shall be a resilient seat wedge (gate) type valve meeting Bath Water District specifications for these type valves. One end shall be flanged and the other end mechanical joint.

1.2. Unless otherwise specified all mechanical joint tapping sleeves valves must be manufactured in the United States or Canada.

2. Installation:

2.1. The tapping sleeve and valve shall be installed such that the valve is plumb with the vertical plane.

XIV. BOLTS AND NUTS:

1. Construction and Design:

1.1. Bolts and nuts shall be either Type 316 stainless steel or Zinc coated Corten steel, depending on the application (see individual specifications).

a. 316 stainless steel contains the following chemical composition:

- Carbon - 0.08 percent max.
- Manganese - 2.0 percent max.
- Silicone - 1.0 percent max.
- Phosphorus - 0.04 percent max.
- Sulfur - 0.03 percent max.
- Chromium - 16 to 18 percent
- Nickel - 10 to 14 percent
- Molybdenum - 2 to 3 percent
- SAE No. - 30316
- ASM No. - 5361A, 5524A, 5573, 5648B, 5690D

b. Zinc coated Corten steel is the trade name for cold formed T-Head bolts containing alloying elements such as copper, nickel, and chrome, with the following chemical composition;

- Carbon - 0.20 percent max.
- Manganese - 1.25 percent max.
- Sulfur - 0.05 percent max.
- Nickel - 0.25 percent min.

- Copper - 0.02 percent min.
- Combined (Ni, Cu, Cr) - 1.25 percent min.

XV. SERVICE SADDLES

1. Construction and Design:

    1.1. The service saddle shall be ductile iron or stainless steel construction meeting ASTM A536-80, Grade 65-45-12 and nylon coated to 10 mils thickness (not shop coat painted). There shall be two holding bands, U-bolt type, made of 304 or 316 stainless steel with Teflon coated threads.

    1.2. Threads on the stainless steel U-bolts shall be CC (AWWA) or FEIP

    1.3. The sealing gasket(s) shall be virgin NBR rubber (ASTM D2000) compounded for water and sewer service.

    1.4. All nuts and washers shall be Type 304 stainless steel according to Bath Water District specifications.

2. Installation:

    2.1. The use of service saddles by anyone other than Bath Water District personnel is strictly prohibited.

XVI. STAINLESS STEEL REPAIR CLAMPS

1. Construction and Design:

    1.1. Stainless steel repair clamps shall be SS I - single section or SS2 - double section, constructed of 304 (18-8) stainless steel with Teflon coated, rolled 5/8-inch N.C. thread bolts, and be 16-inch in length.

    1.2. Nuts, bolts and sidebars shall be nylon coated, heavy gauge 304 (18-8) stainless steel.

    1.3. Lifter bars will be heavy gauge 304 (18-80) stainless steel, TIG/MIG welded with chemical passivation of all welds, and have a lip curve to hold the bolts in place while tightening the clamp.

    1.4. A self lubricating washer will be between the hex nut and lifter bar assembly. Gaskets will be full length, meeting ASTM D2000-(AA415) and have grids in a square pattern and tapered ends, made of virgin SRB rubber compounded for water service.

    1.5. Single bolt “leak” type clamps will not be accepted.

2. Installation:

    2.1. Stainless steel repair clamps shall be used for pipe sizes 2-inch through 6-inch only. Repairs for 8-inch and larger shall be conducted by replacing the damaged section with a new section of the applicable size ductile iron pipe and joined to the existing sections with the appropriate coupling sleeves.

    2.2. The use of stainless steel repair clamps by anyone other than Bath Water District personnel is strictly prohibited.

XVII. BUTTERFLY VALVES

2. Construction and Design:

2.1. All butterfly valves for water service shall be manufactured in accordance with the latest edition of AWWA C504. Valves shall be mechanical joint.

2.2. Valve flanges shall be faced and drilled per ANSI B 1 6. 1, standard for cast iron flanges. Mechanical joints shall be according to C110/ANSI/A21.11. Valve body shall be cast iron conforming to the latest edition of ASTM A126, Class B. Carbon steel is not acceptable.

2.3. Valves shall be cleaned and shop primed on the outside with a rust inhibitive primer. Butterfly valves shall have an exterior coating system of hi-build, epoxy protective coating, that is holiday free and, which shall meet all requirements of AWWA C550.

2.4. All butterfly valves shall have an interior coating system of epoxy protective paint, that is holiday free and, which shall meet all requirements of AWWA C550. The interior epoxy coating shall not impart taste or odor to the water, and shall be a product acceptable to the National Sanitation Foundation (NSF) for use in potable water, and shall be so listed in the most current NSF summary of approved coating products. All surfaces shall be prepared, and coatings applied and cured; in strict compliance with the coating manufacture's instructions and cautions, under controlled factory conditions. Field application of valve coating systems is strictly prohibited.

2.5. Valve shafts shall be 300 series stainless steel and shall conform to the latest edition of AWWA Class 150B. Shafts for valves less than or equal to 20 inches in diameter shall be solid one-piece shafts. Shafts for valves greater than 20 inches in diameter shall be one or two-piece shafts.

2.6. For valves 8 inches and larger, disc shall be ductile or cast iron, with nickel edge welded or screwed in place. Cast iron shall conform to the latest edition of ASTM A48. Valve disc shall be secured to shaft by 300 series stainless steel pins. For valves less than 4 inches in diameter, disc shall be bronze conforming to the latest edition of ASTM B 143, Alloy IA.

2.7. Bearings shall be nylon or phenolic backed PTFE.

2.8. Seat shall be manufactured from nitrile-butadiene elastomer in accordance with the latest edition of ASTM D2000.

2.9. Shaft seals shall protect the internal and external bearings. Shaft seals shall be manufactured from- nitrile-butadiene elastomer in accordance with the latest edition of ASTM D2000. Shaft seals for valves 20 inches or less in diameter shall be self-compensating. Shaft seals for valves greater than 20 inches in diameter shall be adjustable.

2.10. All valves shall be Class 200; 250 psi; working pressure and shall open left

XVIII. PRE-INSULATED DUCTILE IRON PIPE

2.19 Pre-insulated Push-on Joint Ductile Iron Pipe

2.19.1 Manufacturers: Firms regularly engaged in manufacture of pipe and fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years. Acceptable Manufacturers: Thermal Pipe Systems, Inc. or Engineer's approved equal.

2.19.2 Pre-Insulated Push-on Joint Ductile Iron Piping System

2.19.2.1 Pre-insulated pipe shall consist of a push-on joint ductile iron carrier pipe and polyurethane foam insulation surrounded by PVC casing pipe. Gaps in the casing pipe, if any, shall be insulated and covered with split PVC sleeves retained by stainless steel bands or clamps.
2.19.2.2 Ductile Iron Carrier Pipe shall be push-on joint type conforming to AWWA C151. Pipe shall be class 52 in sizes 4" through 8" and class 51 in sizes 12" - 30". Bell and spigot connections shall be in accordance with ANSI/AWWA C111
2.19.2.3 The polyvinyl chloride (PVC) casing pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784, Class 12454-B. For 8" carrier pipe the minimum casing thickness shall meet class 52 standards. This jacket in combination with the foam system shall be suitable for H-20 highway loading with two feet of cover providing that the pipe bedding and backfill material are properly placed and compacted to H-20 specifications.
2.19.2.4 End seals for pre-insulated ductile iron pipe shall be compression rubber.
2.19.2.5 Polyurethane foam insulation shall completely fill the annular space and meet the following specifications:

Type:	Two component urethane
Compressive Strength:	35 p.s.i. parallel min at 5% Comp
Shrinkage:	None at 70ºF
Free Rise Density:	2.0 to 3.0 lbs/cubic foot
Aged "K" (70ºF - 72 hrs)	0.140 BTU-in/hr-ft²-ºF
Closed Cell Content:	90%
Minimum Thickness of foam around 8" DI carrier pipe:	1.9 inches

2.19.2.6 Insulation concentricity: Carrier pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

2.19.3 Installation of the piping system shall be done in accordance with the following specifications and instructions. A manufacturer's field representative shall conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

2.19.3.1 To the extent possible, pipe shall be accurately prefabricated at the factory to dimensions established at the construction site and worked into place without excessive springing or forcing, properly clearing all openings and equipment. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed. Field cuts, if necessary, must be pre-approved by the District and performed in accordance with the manufacturer's recommendations using the proper tools.
2.19.3.2 Pipe and fittings shall be assembled in strict accordance with the manufacturer's printed directions by personnel who have been instructed in installation procedures by the manufacturer's representative.

END OF SECTION