

AUBURN WATER DISTRICT

WATER DISTRIBUTION SYSTEM STANDARDS AND SPECIFICATIONS

Adopted April, 2005

Updated July 19, 2023

PART 1: – GENERAL

1.1 - General Requirements

- A. Attention is directed to the Rules and Regulations of the Auburn Water District (DISTRICT) and are hereby made a part of these Specifications.
- B. The Contractor shall be responsible for a working knowledge of the requirements and Rules and Regulations of the DISTRICT prior to beginning any work.
- C. All applications (and associated fees) to the DISTRICT shall have been completed and submitted to and approved by the DISTRICT prior to beginning any work. A properly prepared, up-to-date drawing of the proposed work shall be submitted to the DISTRICT for review and comment.
- D. It shall be the responsibility of the Contractor to contact DIG SAFE (1 888 344-7233), and the DISTRICT and all other applicable utilities at least 72 hours in advance of the beginning of construction.
- E. It shall be the responsibility of the Applicant / Contractor to obtain and comply with all the requirements of the applicable road opening permits (Town of Auburn, Mass. Highway Dept., etc.).
- F. All work shall be completed in accordance with these specifications and standard industry practices and methods. All materials to be used as part of the water distribution system or connections thereto, shall meet the requirements of the applicable American Water Works Association (AWWA) Standard.
- G. No work shall be backfilled without being inspected by the DISTRICT.
- H. Any materials damaged during unloading, storage or installation shall be immediately removed from the site and replaced at the Applicant / Contractor's expense.
- I. All surface restoration of disturbed areas shall be the responsibility of the Applicant and authorized agent there of (Contractor). Upon completion of the work, all surfaces and surface features, (including pavements, walks, drives, fences, walls, lights, lawns, landscaping, etc.) shall be left in a condition that is at least equal to or better than that which existed prior to construction. All pavements within the Town of Auburn or State Right of Way shall be restored in accordance with the applicable road opening permit and or established standards.

- J. No water main or service will be accepted by the DISTRICT and or activated until such time as the DISTRICT has received all outstanding documentation (shop drawings, as-built drawings, etc.) and fees and outstanding charges).
- K. The DISTRICT reserves the right to periodically modify these standards and to waive parts or requirements thereof should it be in the best interest of the DISTRICT to do so.
- L. No person other than DISTRICT personnel shall operate any valve, hydrant or other component of the DISTRICT's water distribution system.

1.2 - Submittal Requirements

- A. The decision of the equality of materials, products, assembly or system, other than those named or described in these specifications shall be made by the DISTRICT based upon information provided by the applicant. All costs relating to providing said information (samples, testing, etc.) shall be the responsibility of the Applicant or authorized agent thereof (i.e. Contractor).
- B. The Contractor shall submit the following products (if used) to the DISTRICT or its Engineer for approval:
 - Pipes
 - Fittings
 - Valves
 - Hydrants
 - Service Materials
 - Road Boxes
- C. An accurate, scaled "As-Built" drawing shall be prepared by the Contractor using measurements and dimensions taken by the Contractor during installation of the water system components. Distances from permanent surface features (building corners, utility poles, edge of curbs, etc.) to buried valves, pipe bends and fittings etc. shall be shown on the drawings as well as any other pertinent information such as pipe size and material, depth of bury and clearances between the water lines and other crossing utilities such as gas, electrical, sewer and drain.

PART 2: - PRODUCTS

2.1 Quality Assurance

- A. The following information pertaining to products is included for the Contractor's information.
- B. The Contractor shall install all ductile-iron pressure pipe, fittings (including special castings), service connections and appurtenant materials and equipment, as herein specified and in accordance with the submitted plans.
- C. Wherever a pressure classification (e.g. Class 150) is indicated or specified, it shall mean that working pressure for ANS A21.50-1971 laying condition B under five (5) feet of

cover as defined by the applicable standard specification for the type of pipe to which it pertains.

- D. Joints in buried exterior pipelines shall be push-on joints. Buried valves and fittings shall be mechanical joint. Joints, valves and fittings in exposed pipelines shall be flanged joints. Joints in service connections shall be compression type.

2.2 - Standards

- A. ANSI/AWWA C104/A21.4-90 Standard Specifications for Cement-Mortar Lining for Cast-Iron Pipe and Fittings for Water.
- B. ANSI/AWWA C110/A21.10-87 Standard Specifications for Cast Iron Fittings, three (3) inches through forty-eight (48) inches, for Water and Other Liquids.
- C. ANSI/AWWA C111/A21.11-90 Standard Specifications for Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.
- D. ANSI/AWWA C115/A21.15-88 Flanged Cast Iron and Ductile Iron Pipe with Threaded Flanges.
- E. ANSI/AWWA C150/A21.50-81 (R86) Standard Specifications for Thickness Design of Ductile-Iron Pipe.
- F. ANSI/AWWA C151/A21.51-86 Standard Specifications for Ductile-Iron Pipe Centrifugally Cast in Metal or Sand-Lined Molds for Water or Other Liquids.
- G. ANSI/AWWA C153/A 21.53-88 Standard Specifications for Ductile Iron Compact Fittings, 3 inch through 16 inch for Water and of other Liquids.
- H. ANSI/AWWA C-500 A-86 Standard for Gate Valves, 3 thru 48 inches NPS For Water and Sewage Systems.
- I. ANSI/AWWA C502-85 Standard Specifications for Dry Barrel Fire Hydrants.
- J. ANSI/AWWA C504-87 Standard for Rubber Seat Butterfly Valves.
- K. ANSI/AWWA C509-87 Resilient-Seated Gate Valves for Water and Sewerage Systems.
- L. ANSI/AWWA C550-90 Standard Specification for Protective Interior Coatings for Valves and Hydrants.
- M. ANSI/AWWA C800-89 Standard for Underground Service Line Valves and Fittings.
- N. ANSI/AWWA C901-88 Standard for PE (Polyethylene) Pressure Pipe and Tubing for Water Service.
- O. ANSI-B16.1 Standard Specifications for Cast-Iron Pipe Flanges and Flanged Fittings, 25, 125, 250 and 800 pounds, B16.1-1967.

2.3 - Ductile-Iron Pipe

- A. All ductile-iron pipe shall be designed in accordance with the above-mentioned ANSI/AWWA C150/A21.50-81 (R86).
- B. Unless otherwise indicated or specified, double thickness, cement lined ductile-iron pipe shall be at least thickness Class 52.
- C. Prior to delivery to the site, each piece of ductile-iron pipe shall be individually tested to insure 100 percent ductility by the ball impression test or an approved equal.
- D. Buried joints (pipe to pipe) shall be of the push-on type.

2.4 - Fittings

- A. Fittings shall conform to the requirements of the above-mentioned ANSI/AWWA C110/A21.10-87 or ANSI/AWWA C-153/A21.53-88 and shall be of a pressure classification at least equal to that of the pipe with which they are used.
- B. All buried fittings shall be mechanical joint.
- C. Fittings may be either cast or ductile iron.
- D. Fittings shall be cement lined in accordance with ANSI/AWWA C104/A21.4-90.
- E. Tapping sleeves, if used, shall be the full mechanical joint type cast iron sleeve. Sleeves of stainless steel or with "O" ring type seal ring will not be allowed.
- F. Sleeve type couplings shall only be used with the prior approval of the superintendent or Engineer. If allowed, sleeves shall be of the solid type (cast or ductile iron) with mechanical joint ends. The use of "Dresser" style (ductile or cast iron) couplings shall only be used with the prior approval of the Superintendent.

2.5 - Types of Joints

- A. Joints for push-on and mechanical joint pipe shall conform to ANSI/AWWA C111/A21.11-90.
- B. The plain end of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.
- C. The plain ends of field cut pipe shall be chamfered to prevent damage to the gasket.
- D. Push-on and mechanical joint pipe and fittings shall be provided with sufficient quantities of accessories conforming to ANSI/AWWA C111/A21.11-90.

- E. Flanges for flanged pipe shall conform to ANSI B16.1, except that special drilling or tapping shall be as necessary to insure correct alignment and bolting. Flanged pipe shall use long-hub flanges which shall be screwed on tight at the foundry by machine before they are faced and drilled.
- F. Gaskets shall be of a composition suitable for exposure to the liquid with the pipe.

2.6 - Lining and Coating

- A. All pipe and fittings shall be lined and coated as specified below.
- B. The inside of pipe and fittings carrying potable water shall be given a double thickness cement lining and bituminous seal coat in accordance with ANSI/AWWA C104/A21.4-90.
- C. The outside of pipe and fittings shall be given the standard bituminous coating.
- D. Machined surfaces shall be cleaned and coated with a suitable rust preventative coating at the shop immediately after being machined.

2.7 - Water Service Materials

- A. Residential family (single family) service pipe shall be 1-inch diameter polyethylene (PE) Class PC200 pressure pipe/tubing for water service conforming to ANSI/AWWA C901-88 or 1-inch diameter Type K copper.
- B. Commercial service pipe shall be a minimum of 2-inch diameter PE Class PC200 pressure pipe/tubing for water service conforming to ANSI/AWWA C901-88. Commercial services larger than 2 inches shall be ductile iron.
- C. Stainless steel inserts within the PE tubing shall be used at all compression connections.
- D. Corporation stops for all water main service pipe connections shall be of solid brass or bronze construction suitable for compression type connections for the indicated service pipe. The corporation stops shall have AWWA (tapered) thread on the inlet side of the stop. The size of the corporation shall be matched to the size of the service pipe or tubing. Corporations shall be as manufactured by. NO SUBSTITUTIONS WILL BE ALLOWED.
- E. All curb stops for service pipe connections shall be of solid brass or bronze material. The inlet and outlet shall be as required to suit the types of pipe or tubing connected. The curb stops shall not have a drain and include a check stop and shall be manufactured by Ford Meter Box Company. NO SUBSTITUTIONS WILL BE ALLOWED.
- F. Service boxes shall be a two-piece adjustable "Mueller Erie-Style box with a plug style cover (with brass plug) for 5.5 to 6.5 foot depth. Service boxes shall include a 30-inch stainless steel rod and non-ferrous cotter pin for each service connection.

- G. All adapters and miscellaneous fittings to connect to existing or proposed water service materials shall provide an adequate seal at the working pressure of the water main.

2.8 - Valves

- A. Valves three (3) to twelve (12) inches in size, inclusive, shall be designed for a minimum working water pressure of 200 psi.
- B. All valves shall open left in accordance with the Auburn Water District Standards.
- C. The valves shall be designed so that parts subject to wear may be easily replaced and shall be constructed of wear-resistant material.
- D. Valves smaller than 12 inches shall be non-rising stem resilient seated gate valves conforming to the most recent edition of ANSI/AWWA C509-87 and shall, in addition, meet the following requirements:
 - a. The valve waterway shall be smooth and unobstructed (100% full body) without depression or cavities where foreign material can accumulate.
 - b. All interior and exterior ferrous parts, including the interior of the gate or wedge, shall be coated with fusion-bonded epoxy. Said coating shall be non-toxic, impart no taste to water and shall conform to AWWA C-550, the latest revision.
 - c. The gate shall be totally encapsulated with rubber coating that utilizes a rubber seating edge at the bottom, which will eliminate the possibility of entrapment of foreign material.
 - d. The valve shall close bubble tight.
 - e. The valve shall be designed so no metal fasteners or screws other than the stem and stem nut are exposed to water.
 - f. The stem shall be bronze with an integral thrust flange, o-rings and anti-friction devices to reduce operating torque.
 - g. When used as a tapping valve, the valve shall be constructed to permit the use of standard full-size cutters.
 - h. Buried valves shall have mechanical joint ends and a 2-inch square operating nut.
 - i. Buried valves (Post Indicator Valve) controlling water supplies for fire protection systems shall carry the UL/FM rating as appropriate and be supervised per applicable codes.
 - j. Bonnet bolts / nuts shall be stainless steel.

- k. Valve stuffing box shall utilize multiple o-ring seals.
 - l. Resilient seated gate valves shall be as manufactured by American Flow Control (Series 2500), M&H or approval equal.
- E. Valves 12 inches and larger shall be the butterfly type valve with mechanical joint ends and a 2-inch square operating nut and comply with the most recent edition of ANSI/AWWA 504-87 for butterfly valves.
- a. The butterfly valve shall be designed for a working pressure of 200 PSI unless otherwise indicated.
 - b. The valve seat shall have a constant uninterrupted 360-degree seating.
 - c. The valve operator shall be designed for 450 foot-pounds of torque.
 - d. The valve shall have a fusion bonded epoxy coating inside and out.
 - e. Butterfly style valves shall be Model 450B as manufactured by M & H Valve Co. or approved equal.
- F. Buried valves shall be provided with adjustable gate boxes. Where necessary, valves shall be furnished with steel extension stems or universal-joint operating rods with two (2) inch square operating nuts at the upper end and a suitable coupling to connect the valve stem so that the operating nut is no more than 4 feet below the surface.

2.9 - Tie-rods, Clamps, Thrust Restraint

- A. The Contractor shall furnish and install Tie-rods, clamps, couplings, concrete and accessories to prevent the movement of branch valves and/or fittings.
- B. The claims and Tie-rods shall be of the sizes, materials and shall be constructed as indicated by the latest edition of the National Fire Protection Association's National Fire Codes, Publication: NFPA 24.
- C. The use of retainer glands is allowed as an alternative to rods provided the gland used meets the following:
 - a. The restraining devices shall not damage the pipe wall or lining.
 - b. A device to indicate proper tightening of setscrews shall be used.
 - c. Retainer glands shall be "Mega lug" as manufactured by EBBA Iron Sales or approved equal.

2.10 - Valve Boxes

- A. Unless otherwise specified or required, each buried valve shall be provided with a valve box. Valve boxes shall be cast-iron and of the adjustable, slip, heavy-pattern type. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve.
- B. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and fit over the valve bonnet. The boxes shall be adjustable through at least six (6) inches vertically without reduction of the lap between sections to less than four (4) inches.
- C. The inside diameter of boxes shall be at least 5 1/4 inches and the lengths shall be as necessary for the depth of the valves with which the boxes are to be used.
- D. Covers shall be close fitting and substantially dirt tight. The top of the cover shall be flush with the top of the box rim. The word "Water" shall be cast in the top of the cover.
- E. Castings for valve boxes shall be strong, tough even grained, and without defects.

2.11 - Hydrants

- A. Hydrants shall be manufactured in accordance with the most recent edition of AWWA Specification C502-85, designed for a minimum of 200 pounds working pressure, and tested to a minimum of 400 pounds hydrostatic pressure and shall open LEFT.
- B. The hydrant shall be center stem compression type.
- C. An automatic drain is to be provided to permit draining the hydrant barrel.
- D. Hydrants shall be designed with the following features:
 - a. Permit removal of all working parts through the top without the use of any special tools or wrenches. All working parts shall be bronze and interchangeable, with similar parts of same size and type.
 - b. In the event of accident, damage or breaking of hydrant, the main valve will remain closed by mechanical means.
 - c. The direction of the nozzles can be changed 360 degrees by rotating the hydrant without digging up the hydrant.
 - d. Extensions may be added without the necessity of closing off the water or digging up the fire hydrant.
- E. Hydrants shall have a minimum valve opening of 5¼ inches.

- F. Inlet connection shall be six (6) inches and mechanical type joint.
- G. Hydrants shall have two (2) 2½ inch hose nozzles and one (1) 4½ inch pumper nozzle. Nozzle threads to be National Standard. Operating nuts shall be National Standard, pentagon shape, 1½ inch point to flat. Hydrants shall be suitable for installation with a minimum of five (5) foot depth of cover at the inlet connection without the hydrant being significantly higher or lower than as indicated on the drawings.
- H. Hydrants manufactured for a greater depth of bury shall be provided where depth of coverage over the water main is greater than the standard 5 foot of cover. Said hydrant shall be prominently marked with the depth of bury.
- I. Hydrants shall be furnished with a frangible break flanged at the groundline and a cast-iron break coupling on the stem at the groundline, which shall be so designed so that in case of breakage, only the flange and coupling need be replaced to affect complete repair.
- J. Hydrants shall be painted red and shall open LEFT in accordance with the standards of the Auburn Water District.
- K. Hydrants shall be the Darling Model B-84-B as manufactured by American Flow Controls. NO SUBSTITUTIONS WILL BE ALLOWED.
- L. Hydrants installed at locations which, in the opinion of the DISTRICT, may be subject to possible damage from vehicles, said hydrant shall be protected by a minimum of two 6" diameter concrete filled steel bollards placed to facilitate full unrestricted access to the hydrant.
- M. Hydrant Thrust Blocks: Concrete for thrust blocks securing hydrants shall be sized and installed to provide adequate thrust restraint for the soil type encountered.

2.12 – Backflow Prevention Devices

- A. Backflow prevention devices shall be provided by the customer on all commercial services and on any other services where required. Said approved devices shall be installed on the customer side of the meter and shall installed per DEP requirements by a qualified individual in a suitable location where it is convenient for testing and will not compromise the décor or operation of the business. During the required periodic testing of said devices, it is required to interrupt the water supply to the building for a period. If said interruptions of service during normal business hours cannot be tolerated, it is required that an additional device be installed in parallel that would allow one backflow preventer to be taken offline at a time for testing while the other remains in service.
- B. Back flow prevention devices shall be of the Reduced pressure zone type as manufactured by Watts.

PART 3: - EXECUTION

3.1 - Water Distribution Main

- A. The Contractor's attention is directed to the fact that the cement pipe lining is relatively brittle. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining.

Any fitting or pipe showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work site.

In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by the DISTRICT, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least twelve (12) inches from the visible limits of the crack.

Unless otherwise approved, all cutting of ductile iron pipe shall be done with an approved power operated cutter. Hammer and chisel shall not be used to cut pipe. All ends shall be examined for possible cracks caused by cutting and chamfered to prevent damage to the gasket.

Pipe shall be installed as to maintain the required minimum earth cover (5 foot) vertically over and horizontally from the sides of the pipe. Piping not having the necessary vertical or horizontal cover shall be restrained against movement and protected from freezing.

- B. Before any length of pipe is lowered into the trench it shall be inspected for damage and the inside of the pipe shall be cleaned of any loose dust and foreign objects. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid shall be removed and replaced by a sound and satisfactory piece at the Contractor's expense.

Each pipe and fitting shall be carefully cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.

Pipe Location. Exterior pipelines will be located substantially as indicated on the approved drawings, but the right is reserved to the DISTRICT, to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings, etc., are noted on the approved drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different additional or different fittings, where required, without additional compensation. (Care shall be taken to ensure a good alignment both horizontally and vertically, and, in the case of buried lines, to give the pipe a firm bearing along its entire length.)

All dead end water mains will end on a fire hydrant. No service connections will be allowed after the last hydrant.

All new taps shall be a minimum of one pipe size smaller in diameter than the main to be tapped; however, where the District deems this to be impractical then a solid sleeve three-way branch shall be used to connect to the new main.

When mechanical joint pipe or similar pipe is laid, the bell of the pipe shall be cleaned of excess tar or other debris and wiped out before the cleaned and prepared end of the next pipe is inserted into it. The new pipe shall be set and held firmly in place until properly seated and held securely until the joint has been completed.

- C. Before any section of pipe is joined with another with a push on type joint, it shall be inspected for damage and the inside of the pipe shall be wiped clean and clear of any debris. Surfaces against which the gaskets will come into contact shall be thoroughly wire brushed and washed with clean water, care being taken that no sand or grit be allowed to remain on these surfaces. The gasket shall then be cleaned and inserted in the groove provided in the bell of the previously laid pipe, making sure the gasket is inserted in the proper manner and securely seated. The gasket and the plain pipe end shall be lubricated with an approved lubricant in accordance with the pipe manufacturer's literature. The ends of cut pipe should be checked before assembly to ensure that they have been chamfered to facilitate assembly and prevent tearing of the gasket.

Special care must be given by the Contractor to use the proper gaskets designed and manufactured for the brand of pipe being installed or connected to. Avoid mixing different gaskets together.

The plain end of the pipe shall then be aligned to be in line with the previously set length of pipe and inserted into the gasket, and pushed through the gasket until seated in the bell. If the joint cannot be assembled with a reasonable amount of force, the plain end shall be removed from the bell and the gasket shall be checked for proper positioning before reassembly. If an effective seal is not obtained at the joint, the joint shall be disassembled, cleaned, and reassembled, utilizing a new gasket.

Pipe shall be deflected after the plain end has been fully seated within the bell. The amount of deflection shall not exceed the maximum allowable deflection indicated by the pipe manufacturer and accepted standards.

- D. Before any section of pipe is joined with another with a mechanical type joint, it shall be inspected for damage and the inside of the pipe shall be wiped clean. Any excess coating in the bell section shall be removed to prevent an improper fit.

The plain end, bell socket, and gasket shall be wiped clean, and washed with a soap solution to improve seating of the gasket and provide lubrication. The gland shall be placed on the plain end with the lip extension towards the plain end of the pipe followed by the gasket with the narrow edge towards the plain end of the pipe.

The plain end of the pipe shall then be centered and pushed into the bell socket and the gasket pressed firmly and evenly around the socket. The gland shall be pushed up to

the bell and centered with the gland bolts being inserted and evenly tightened until "finger tight".

The tightening of the bolts shall be completed with diametrically opposite bolts being tightened in sequence so as to keep the gland square with the socket and produce even bolt stresses.

The correct range of torque to be obtained is shown below, preferably by means of a torque wrench:

Bolt Size (Inches)	Range of Torque (Ft. Lbs.)
5/8	45 - 60
3/4	75 - 90
1	85 - 100

If an effective seal is not obtained at the joint at the maximum torque indicated above, the joint shall be disassembled, thoroughly cleaned and reassembled with a new gasket. Bolts shall not be over-torqued to tighten leaking joints.

- E. Flanged ductile iron pipe and fittings shall be assembled in accordance with the manufacturer's literature.
- F. In laying ductile iron pipe, the following deflections, which reflect the manufacturer's allowable recommended maximum deflection, shall not be exceeded.

Nominal Size of Pipe - Inches	Deflection - Inches / Pipe Radius (Feet) For 18 Foot Pipe Length	
	PUSH ON JOINT	MECHANICAL JOINT
4	19" / 205ft.	31" / 125ft.
6	19" / 205ft.	27" / 145ft.
8	19" / 205ft.	20" / 195ft.
10	19" / 205ft.	20" / 195ft.
12	19" / 205ft.	20" / 195ft.
16	11" / 340ft.	13.5" / 285ft.

Deflections shall be made after the joint is made. For mechanical joint pipe, the bolts shall be partially tightened before the length of pipe is deflected.

- G. At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe is eliminated. In the event that pipe is installed by transporting the underwater section as a unit through the water, the ends of the pipe shall be closed with suitable temporary plugs.
- H. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of eight inches. Soapy water may be used as a gasket lubricant. A follower and gasket in that order shall be slipped over each pipe to a distance of about six inches from the end, and the middle ring shall be placed on the

previously laid pipe end until it reaches the pipe stop or is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position against the pipe stop or in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, by the use of a torque wrench of the appropriate size and torque for the bolts.

- I. All valves, fittings, and appurtenances installed shall be set and jointed by the Contractor as indicated on the Drawings.
- J. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the Drawings or specified. Unless approved otherwise, all bends, tees, dead-end plugs/caps, and other fittings in ductile iron pipelines buried in the ground shall be restrained to resist thrust with concrete placed in an approved manner against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then suitable bridle rods, clamps, and accessories to brace the fitting properly shall be provided. Such bridle rods, etc., shall be coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly.
- K. All backfill around installed pipe and appurtenances, shall be clean, dry material free of frozen material, mud, organics, bituminous concrete, debris, etc. No stone larger than 3 inches shall be placed within 12 inches of the installed pipe. The remaining backfill shall not contain any rock, stone or pieces larger than 6 inches. Proper compaction shall be performed with vibratory compactors in lifts not exceeding one foot. Compaction shall be at least 90% under non-paved areas and 95% under pavements.
- L. The ductile iron pipe shall be given pressure and leakage tests in sections of approved length. For these tests, the Contractor shall furnish all labor and materials including an approved pump, tanks, hoses, meters and pressure gauges. The Contractor shall furnish, install **and remove (after testing)** suitable temporary testing taps, plugs or caps for testing the pipeline; and other similar equipment; and all labor required all without additional compensation. The meter and gauge shall be installed by the Contractor in such a manner that all water entering the section under test will be measured and the pressure in the section indicated, and they shall be kept in use during both tests.

The scheduling of pressure and leakage tests shall be as allowed by the DISTRICT Superintendent.

Unless it has already been done, the section of pipe to be tested shall be slowly filled with water of approved quality, and all air shall be expelled from the pipe by flushing and the test section of pipe be allowed to stabilize preferably for 24 hours. If hydrants or blow-offs are not available at high points for releasing air or for isolating sections of the mains to be tested, the Contractor shall be responsible to make the necessary excavations, backfilling, compaction, and the necessary taps at such points and shall remove the taps and plug said holes with brass or bronze plugs after completion of the test and to restore the surface.

For the pressure test, the Contractor shall, by pumping, raise the water pressure (based on the elevation of the section under test and corrected to the gauge location) to a minimum of 150 pounds per square inch or to a pressure equal to 150% of the normal static pressure, at the highest point of the section being tested, whichever is larger*. If the Contractor cannot achieve the specific pressure and maintain it for a period of two (2) hours, the section under test shall be considered as having failed to pass the pressure test.

**Higher test pressures may be required by the Water Superintendent, but not to exceed the rated pressure ratings of the valves or hydrants.*

Only upon completion of a successful pressure test, the Contractor shall make a leakage test by metering the flow of water into the pipe while maintaining in the section being tested a pressure within 5+ psi of the pressure to which the pipe will be subjected under the pressure test for at least two hours. This shall be done by placing the section under pressure by pumping. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{SD (P) 0.5}{133,320}$$

for mechanical joints and push-on joints, in which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

ALLOWABLE LEAKAGE (GALS. PER HOUR) PER 1,000 FT. OF PIPELINE								
NOMINAL PIPE DIAMETER								
Avg. Test Pressure (psi)	3	4	6	8	10	12	14	16
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20

Note:

If testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal./hour per inch of nominal valve size shall be allowed for the leakage test only.

At the specified system pressure, no leakage will be allowed at flanged joints.

If the section shall fail to pass the pressure test, the leakage test, or both, the Contractor shall do everything necessary to locate, uncover, (even to the extent of uncovering the entire section), isolation of pipe sections by capping or installing valves, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work.

If, in the judgment of the DISTRICT, it is impracticable to follow the foregoing procedure exactly for any reason, modifications in the procedure shall be made as required or approved, but in any event the Contractor shall be responsible for the ultimate tightness of the line within the above leakage requirements.

- M. All water mains, after passing the leakage and pressure tests, shall be flushed, disinfected, and flushed again as follows, prior to being put into service. The Contractor shall furnish the necessary labor and pumps, hoses, barrels, taps for proper chlorine distribution, and chlorine test kits for the disinfection procedure.

All water mains shall be thoroughly flushed to clear the pipe of debris and sediments prior to disinfection. The flushing rate shall be at least 2.5 fps for mains smaller than twenty (20) inches in diameter. The flushing velocity in pipes greater than twenty (20) inches in diameter may be at a lower rate, as approved. The following table lists the required opening to flush pipelines to obtain a velocity of 2.5 fps and is taken from AWWA Standard C651.

**REQUIRED OPENINGS TO FLUSH PIPELINES*
TO PRODUCE 2.5 FPS VELOCITY**

PIPE SIZE (IN.)	REQ'D FLUSHING RATE (GPM)	ORIFICE SIZE	HYDRANT OUTLETS REQUIRED TO BE OPENED		
			(INCH)	(NUMBER)	(SIZE)
4	100		15/16	1	2-1/2
6	220		1-3/8	1	2-1/2
8	390		1-7/8	1	2-1/2
10	610		2-5/16	1	2-1/2
12	880		2-13/16	1	2-1/2
14	1,200		3-1/4	2	2-1/2
16	1,565		3-5/8	2	2-1/2
18	1,980		4-3/16	2	2-1/2

*With 40 psi residual pressure, a 2-1/2 in. hydrant outlet nozzle will discharge approximately 1,000 gpm and a 4-1/2 in. hydrant nozzle will discharge approximately 2,500 gpm.

The disinfection of water mains shall be accomplished in accordance with latest edition AWWA Standard for Disinfecting Water Mains, C651, and/or the DEP Water Supply Guidelines for Public Water Systems, whichever of the two (2) is more stringent. The following descriptions may be used as a guide:

- i. Disinfection of mains should be accomplished only by workmen who have had experience with chlorine or other disinfecting agents. Liquid chlorine (gas at atmospheric pressure and sodium hypochlorite solutions are the most common disinfectants used. Chlorine gas and water solutions are fed into the main being disinfected to a concentration of at least 50 parts per million available chlorine. To ensure that the required concentration is maintained, chlorine residuals are

obtained. This chlorinated water solution should remain in the pipe for at least 24 hours, at the end of which period the chlorine concentration should be at least 25 parts per million. If this is achieved, final flushing can be accomplished, and chlorine residuals checked to determine that the heavily chlorinated water has been removed from the pipeline. Said chlorinated water shall be disposed of in a safe, proper and legal manner.

**CHLORINE REQUIRED TO PRODUCE 50 mg/L
CONCENTRATION IN 100 FT. OF PIPE - BY DIAMETER**

Pipe Size in.	100 percent Chlorine lb.	1 percent Chlorine Solutions gal.
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

- ii. The Slug Method of Chlorination, which is used for large diameter water mains consists of moving a column of highly concentrated chlorine water solution (at least 300 ppm) along the interior of the pipe with a contact time of at least three hours with the pipe wall. (See AWWA Standard C651 Section 7.2 for further information).
- N. After the applicable retention period, the heavily chlorinated water shall be disposed of or neutralized and the main flushed until the chlorine concentration in the water leaving the main is equal or less than that of the prevailing system or less than 1 mg/L.
- O. After final flushing and before the water main is placed in service, a sample or samples shall be collected from the water main at locations approved by the DISTRICT Superintendent and tested for bacteriological quality and shall show an absence of coliform organisms. In the case of extremely long mains several samples shall be collected along its length, as well as the end. The Contractor shall obtain suitable sample containers, take samples under the direction of the DISTRICT Superintendent, submit samples to a Department of Environmental Protection certified laboratory for analysis, and see that analysis reports are sent to the Engineer and the DISTRICT. The Contractor shall bear the costs for said sampling, delivery and tests.
- If the initial disinfection fails to produce satisfactory samples, the disinfection process shall be repeated at the Contractors expense.
- P. The Contractor shall submit a program for the construction and putting into service of the new works subject to the approval of the DISTRICT. All work involving cutting into and connecting to the existing work shall be planned so as to interfere with operation of the existing facilities for the shortest possible time and when the demands on the system best permit such interference even to the extent of working outside the normal working hours to meet these requirements. **For all proposed interruptions of water**

supplies or work to be performed on any component of the existing water distribution system, the Auburn Water District shall be notified forty-eight (48) hours (weekends and holidays excluded) in advance.

The Contractor shall have all possible preparatory work done and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation. Disinfection of affected mains shall be done as part of this operation, in accordance with procedures specified elsewhere.

The Contractor shall have no claim, by reason of delay or inconvenience, for adapting his operations to the needs of the DISTRICT.

- Q. The Contractor shall make joint connections similar to those on the existing pipe or adaptable to such pipe unless specifically otherwise shown on the Drawings or directed. These joints shall be made as specified under the appropriate headings.
- R. Existing pipeline(s), other utilities, and surface features (pavements, lawns, fences, walls, etc.) damaged by the Contractor shall be replaced by him at his own expense in a manner approved by the DISTRICT and the owner of said damaged items. All replications shall result in the restored work being of a condition equal to or better than that has existed before construction.
- S. Temporary pavement (2-inch minimum) shall be placed as soon as possible. All disturbed paved areas shall be paved at the end of the work week. It shall be the responsibility of the Contractor to periodically inspect the patches and maintain them until the permanent pavement is placed.

Permanent pavement surface restoration shall comply with the applicable road-opening permit. Unless specified otherwise, all disturbed pavements shall be replaced with a minimum of 12 inches of compacted gravel with 4 inches (2 ½ inches of binder (base) with 1 ½ inches of top course for roadways and 2 inches of binder (base) with one inch of top course for driveway and walks.

- T. Disturbed lawn areas shall be restored with a minimum of 4 inches of good quality loam, limed, fertilized and seeded with a lawn seed mixture. The Contractor shall be responsible for

3.2 - Water Services

- A. The Contractor shall furnish and install all services to the new main as indicated on the Drawings. All work shall be performed by craftsmen experienced in the installation of water services. The Contractor shall have the option of installing services wet or dry.
- B. Curb stops should be installed within the road right of way as close to the property line as possible. Curb stops shall be provided with a rod and box as specified and shall be set plumb and be supported and protected during backfill. Prior to acceptance of the work, the Contractor shall demonstrate that all buried valves are accessible fully operable with standard valves wrenches.

- C. All openings in foundations for water service piping shall be patched on both the interior and exterior of the foundation.
- D. Services shall be located to facilitate the ease of installation and maintenance of the meter and appurtenances.
- E. All service connections shall be laid in as straight a line as possible to the foundation of the building. Detectable warning tape shall be installed three (3) feet above service line. Tape will read "CAUTION BURIED WATER LINE BELOW".
- F. Surface restoration shall be as described under Section 3.1 Paragraphs R through T.

3.3 - Buried Valves and Appurtenances

- A. All valves shall be carefully erected and supported in their respective positions and free from all distortion and strain. Care shall be taken to prevent damage or injury to the valves or appurtenances during handling and installation. Valve openings and seats shall be cleared at time of installation. Valves, valve boxes and valve box covers shall be installed in such a manner as to ensure that the cover is parallel to the ground surface and that the operating wrench will fit squarely on the operating nut. Equipment which does not operate easily or is otherwise defective shall be repaired or replaced at the Contractor's own expense. Special care shall be taken not to displace the valve box during backfilling, compaction and surface restoration.
- B. The Contractor shall furnish and install tie rods, clamps, couplings, concrete thrust blocks and accessories to prevent the movement of branch valves, as indicated on the Drawings or as directed. All valves at tees shall be restrained back to tee with retainer glands or asphalt coated rods.
- C. All buried valves controlling water services should be installed within the road right of way as close to the property line as possible. All buried valves shall be provided with a box as specified and shall be set plumb and be supported and protected during backfill. Prior to acceptance of the work, the Contractor shall demonstrate that all buried valves are accessible fully operable with standard valves wrenches.

3.4 Hydrants

- A. The exact field location of each hydrant shall be determined by the Auburn Fire Department and the DISTRICT Superintendent prior to excavation for hydrant installation, however hydrants should be located every five-hundred (500) feet in the course of the main or wherever the District deems necessary for proper fire protection or other uses. The hydrant shall be installed as indicated on the Drawings and as per manufacturers recommendations for the proper installation of the hydrant. The hydrant shall be set as to not bury the traffic flange to facilitate repairs without having to excavate around the hydrant. The area around the hydrant shall be graded to permit a 3 foot wide level area all around the hydrant and to provide adequate cover and support on all sides.

The Contractor shall furnish hydrants manufactured for the depth of cover over the mains at the hydrant connection and the actual ground elevation at the hydrant location. A minimum of 5 feet of cover at the inlet connection to the hydrant shall be maintained at all locations.

- B. Hydrants to be set above any potential groundwater table shall include an automatic drain feature. This shall include the necessary drain ring, seat and valve mechanism to automatically allow drainage of the hydrant barrel when the hydrant valve is fully closed. The drain ports shall be automatically closed when the operating rod is turned no more than two full turns.

When the DISTRICT determines that a hydrant will be set in a possible groundwater table, the Contractor shall install a hydrant without a drain feature. This may be done by furnishing a drain ring without drain holes or a special ring with threaded drain outlet, which must be plugged. The method shall be at the Contractor's option, as approved by the DISTRICT.

Hydrants installed without automatic drains shall have the letters "ND" painted on the hydrant barrel in two (2) inch letters just below the outlet nozzle facing the street; the letters shall be a contrasting color.

The installation of those hydrants with an automatic drain feature shall include approximately 1/3 cu. yd. of clean crushed stone placed around the hydrant base to a level several inches above the drain openings.

- C. A set-back of at least four (4) feet but less than eight (8) feet from the edge of the road, to the center point on the hydrant shall be maintained. The steamer nozzle shall face the street unless otherwise directed by the DISTRICT. Hydrants shall be connected to water mains by six (6) inch ductile iron pipe. Each hydrant installation shall include buried gate valve between the hydrant and its supply main to permit isolation of the hydrant for maintenance purposes. The auxiliary valve shall be connected to the anchoring tee unless directed otherwise by the Superintendent. The distance between the auxiliary valve and the hydrant body varies for each installation. All connections at hydrant installations shall be mechanical joint connections with plain rubber gaskets. All joints between and including the anchoring tee on the distribution main and the hydrant shall be restrained by retainer glands or rods. Hydrant ports shall be a minimum 18" above grade.

The hydrants shall be set upon a slab of concrete not less than four (4) inches thick and fifteen (15) inches square. Each hydrant shall be thrust blocked against the undisturbed vertical face of the trench with a concrete thrust block as indicated on the Drawings.

Should soil and/or trench conditions preclude the use of a concrete thrust block, additional tie rods, installed as indicated on the drawings may be used. Tie rods shall be of the number and orientation, size, material and construction as specified by the National Fire Protection Association Codes. All the rods and accessories shall be field coated with a asphalt type material prior to backfilling.

The Contractor shall take special care to ensure that all hydrants are set plumb. When hydrant installation has been completed, including surface restoration of the area

immediately surrounding the hydrant, the Contractor shall apply one field-coat of red paint to the hydrant. The paint shall be compatible with the shop coat and shall be as recommended by the hydrant manufacturer.

3.5 - Temporary By-Pass Piping (if required)

- A. The Contractor shall provide temporary bypass piping in such a manner that adequate pressure shall be available to all affected residences should his work require that the water service to customers be interrupted for more than an 8-hour period. The determination of the need for temporary piping and the size of the piping and service connections is the responsibility of the DISTRICT. The Contractor shall submit his plan to the DISTRICT for approval.

END OF SECTION