

CITY OF AUBURN STANDARD SPECIFICATIONS

SECTION 14 WATER MAINS AND APPURTENANCES

14.01 GENERAL

The work included in this item shall consist of furnishing and installing all ductile iron pipe, cast and ductile iron fittings, copper tubing and fittings, valves and valve boxes, hydrants, manholes, vaults, meters, and other appurtenances incidental thereto as specified herein or as shown on the approved construction drawings. Also included are making connections to existing piping, removing existing piping, pressure testing, disinfection of pipes, and other incidental items of work for which no specific payment will be made.

14.02 CONTRACTOR RESPONSIBILITY

A. Installation and Safety

1. The Contractor shall be responsible for installation of the water mains and appurtenances in accordance with the approved construction drawings, notifying the Project Engineer of any discrepancies noted in actual field conditions.
2. Any changes or alterations to the approved design that are requested by the Contractor shall be reviewed and approved by the Water Works Board of the City of Auburn prior to work beginning in the area of the requested change.
3. Any water main installation that is not in accordance with the approved construction drawings shall be removed and installed properly prior to acceptance by the Water Works Board of the City of Auburn.
4. The contractor shall obtain a Water Main Connection Permit prior to making any connection to the Water Works Board of the City of Auburn's potable water distribution system. All connections to the system must be coordinated and performed in the presence of a City inspector or representative of the Water Works Board of the City of Auburn that is certified as an Alabama Grade I Water Operator. The Permit shall be presented to the inspector or representative of the Water Works Board of the City of Auburn at the time the connection is made.
5. Barricades, flashers, signs, and other protective devices shall be used when needed to adequately provide for public safety. Such devices shall be supplied, installed and maintained by the Contractor. The Contractor will be solely responsible for safety.

B. Certifications

1. All pipe, fittings, valves and other materials shall be new and unused when delivered to the work and shall be suitable for installation and operation under the conditions for which they are to be used. All pipes and all fitting shall be suitably marked at their places of manufacturer to show their class or strength. Any pipe or other materials, which have been broken, cracked or otherwise damaged before or after delivery to the site of work, or which have failed to meet the required tests, shall be removed from the job site and shall not be used in the work.

2. Detailed construction drawings for flanged ductile iron pipe in large meter vaults, pressure producing stations, etc., shall be submitted to the Water Works Board of the City of Auburn and Project Engineer for review before such materials are fabricated and delivered to the job site.
3. The manufacturer of ductile iron pipe, fittings, and gate and butterfly valves shall furnish the Water Works Board of the City of Auburn and Project Engineer, when requested, certification that these materials comply with the appropriate ANSI/AWWA Standard and that compliance has been verified by specified tests and inspection.
4. Other types of pipe, fittings, and valves shall be inspected and accepted under these specifications by an approved commercial testing laboratory prior to delivery to the job site. Each piece of pipe, fitting, etc., shall be stamped with the laboratory's mark of acceptance and inspection reports shall be furnished to the Water Works Board of the City of Auburn and the Project Engineer when requested.

C. Testing

1. The Contractor is responsible for testing all aspects of the water system as outlined in this document in conjunction with the Water Works Board of the City of Auburn.

D. Site Restoration

1. The Contractor shall clean up and legally dispose of all excess material, trash, wood forms, and other debris. Previously grassed areas that are excavated shall be reestablished with sod of the same type and species as the surrounding grass.
2. In unimproved areas, the disturbed ground shall be seeded with approved Alabama Department of Transportation Mix, unless specified otherwise.
3. After completing each section of the water line, the Contractor shall remove all debris, construction materials, and equipment from the site of the work, grade and smooth over the surface on both sides of the line, and leave the entire right-of-way or easement in a clean, neat, and serviceable condition.
4. All permanent easements shall be graded and smoothed to allow sufficient access and use for mowing equipment and maintenance vehicles prior to acceptance by the Water Works Board of the City of Auburn. The permanent easement shall be completely cleared of all trees, brush, boulders, and debris. All rocks shall be buried, crushed, or removed from the easement where, in the opinion of the Water Works Board of the City of Auburn, they present a hazard for access and use of the easement. Typically, no rock shall remain on the ground surface that is larger than a No. 1 stone classification.
5. All creek and ditch crossings shall also be made accessible for mowing and maintenance equipment as deemed appropriate by the Water Works Board of the City of Auburn.

14.03 EXCAVATION AND BACKFILLING

The Contractor shall excavate all substances encountered to the depth shown on the construction drawings. Excavated materials not required for fill or backfill shall be disposed of by the Contractor in a manner acceptable to the Project Engineer or Project Manager.

A. General Excavation Requirements

1. Excess excavation below the required level shall be backfilled with an approved crushed stone, and thoroughly tamped.
2. Unsuitable soil shall be removed and replaced with approved crushed stone or other approved material, and shall be thoroughly tamped.
3. The ground surface adjacent to all excavations shall be graded to prevent water from running into the excavation. The Contractor shall remove any water accumulated in the excavation and keep the trench dewatered.
4. The trench shall be excavated so that the pipe will be laid in the center of the trench in its designed location. The trench width shall be a minimum of six inches (6") larger than the pipe bell diameter, and a maximum of twelve inches (12") larger than the pipe bell diameter.
5. The Contractor shall do all bracing, sheeting, and shoring necessary to perform and protect all excavations as required for safety and to conform to all governing laws.

B. Rock Excavation

1. Rock shall be defined as any material, which occurs in its original position in ledges or bedded deposits of such hardness or texture that cannot be reasonably excavated, loosened, broken, or removed without the use of drilling and blasting methods utilizing a Caterpillar 320, Kobelco 200, Komatsu 220, or comparable trench excavation equipment having a SAE rated net power of at least one hundred and forty-eight horsepower (148 hp) and bucket force of at least thirty-one thousand pounds (31,000 lbs). Concrete and masonry structures that require drilling and blasting for removal and boulders having volumes greater than eight (8) cubic feet shall also be considered rock.
2. In general, removal of rock will be considered as unclassified excavation and no specific payment will be made therefore except when a bid item is provided in the Bid Schedule for rock excavation. When payment is to be made on a unit price basis for removing rock, the rock shall be completely stripped of all overburden over the entire area, if for a structure, and over a length of at least fifty feet (50') if for a pipeline. The Project Engineer, Project Manager or Inspector will then make the necessary measurements and take elevations on the rock to determine the volume of rock to be removed.
3. In no case will pavements, manholes, and similar structures be classified as rock nor will specific payment be made for drilling and blasting materials that can be removed by other methods.

4. Excavations shall be carried six inches (6") below bottom of pipe and bedding material shall be one-fourth of an inch (¼") to one and one-half inches (1 ½") graded crushed stone such as: 56, 57, 6, 67, 68, 7, or 78 stone per ALDOT standard specifications.
5. In trenches for pipelines, rock shall be removed for the overall width of the trench as specified and to a depth of six inches (6") below the bottom of the pipe for pipes smaller than twenty four inches (24") in diameter. If concrete cradles are to be constructed, rock shall be removed to allow the cradle to be constructed to the depth shown on the construction drawings.
6. All storage places for explosives and inflammable materials shall be clearly marked. The method of storing and handling such materials shall conform to all Federal, State, and local laws.
7. Drilling and blasting methods used in rock excavation shall be optional with the Contractor but shall be conducted with due regard to the safety of persons and property in the vicinity of the work and in strict conformity with all laws, ordinances or regulations governing blasting and the use of explosives. Rock excavation near existing structures of all types shall be conducted with the utmost care, and every precaution shall be taken to prevent damage to such structures. Damage or injury of any nature to persons or property, caused directly or indirectly by blasting operations, shall be promptly repaired, replaced or compensated for by the Contractor at his own expense and to the entire satisfaction of the persons injured or the owners of the property damaged.

C. Backfilling

1. After pipes have been visually checked for defects, backfilling shall be done with approved material free from large clods or stones, sticks, logs, stumps, or other unsuitable materials.
2. Backfill material shall be placed evenly and carefully around and over pipe in six inch (6") maximum layers and mechanically compacted. Each layer shall be carefully placed until one foot (1') of cover exists over the pipe. The remainder of backfill materials shall be placed in twelve inch (12") layers and mechanically compacted, unless approved otherwise by the Project Engineer or Geotechnical Engineer.
3. At vaults and other structures, all forms, trash, and debris shall be removed and cleared away. Backfill material shall be placed symmetrically on all sides in twelve inch (12") maximum layers. Each layer shall be moistened and compacted with mechanical tampers.
4. Trenches cut across or along pavement/roadways shall be backfilled with stable granular material, 825B, flowable fill, or approved dirt to a depth of one foot above the pipe, in six inch (6") maximum layers. The remainder of the trench shall be completely backfilled with an approved backfill material to the appropriate subgrade, and mechanically compacted as the material is placed in eight inch (8") maximum layers. Each layer shall be compacted to density of ninety five percent (95%) with the top six inches (6") at least ninety eight percent (98%) so that pavement can be placed

immediately. Temporary asphalt patches shall be placed in accordance with the current City of Auburn Standard Specifications and Details.

5. The Contractor shall be responsible for repairing all settled backfilled areas.
6. Testing compaction of backfill under roadways shall be done in accordance with the testing requirements for street construction in Section 10.

14.04 MATERIALS

In general, metal pipe four inches (4") in diameter and larger shall be ductile iron pipe with "push-on" joints for installation underground and flanged joints for exposed pipe. Fittings for underground pipe shall have mechanical joints and may be made of gray (cast) iron or ductile iron, as noted and approved. Flanged fittings for twelve inch (12") and smaller pipe may be either gray or ductile iron. Flanged fittings larger than twelve inches (12") shall be ductile iron unless shown otherwise on the approved construction drawings.

Any exceptions to these specifications will be noted on the construction drawings and/or in the Special Conditions if applicable.

- A. Ductile Iron Pipe
 1. Ductile iron pipe shall comply with ANSI A21.51 and AWWA C151.
 2. Pipe to be installed underground shall be Pressure Class 350 for size four inches (4") to twenty four inches (24") except where a higher class is shown on the construction drawings, in the Special Conditions, or required due to the depth of the cover shown on the construction drawings based on Type 2 laying condition.
 3. Minimum working pressure shall be two hundred and fifty pounds per square inch (250 psi) plus one hundred pounds per square inch (100 psi) water hammer.
- B. Flanged Pipe
 1. Flanged pipe shall comply with ANSI B16.1 Class 250 and AWWA C110, C115, and C151
 2. Bolts, nuts, and studs for flanged joints shall be hexagonal type of low-carbon steel conforming to ASTM A307 Grade B and ANSI B18.2.
- C. Fittings
 1. Ductile iron fittings, with either mechanical joints or flanges, shall comply with ANSI A21.10 and AWWA C110 or ANSI A21.53 and AWWA C153.
 2. Ductile iron mechanical joint fittings in sizes four inches (4") to twenty-four inches (24") shall have a pressure rating of 350 psi.
- D. Joints/Joint Materials
 1. Ductile iron pipe with "Push-on" and mechanical joints and fittings shall conform to ANSI A21.11 and AWWA C111.

2. Ductile iron pipe with Flanged joints and fittings shall conform to ANSI A21.10, A21.15, B16.1, and AWWA C110.
3. Joint materials for “push-on” and mechanical joints shall be furnished by the manufacturer of the pipe and shall comply with ANSI A21.11.

E. Gaskets

1. Standard gaskets for “push-on” joint ductile iron pipe shall be manufactured of Styrene Butadiene Rubber (SBR) conforming to the material requirements of ANSI A21.11, and AWWA C111, and shall be ANSI/NSF Standard 61 certified for contact with potable water.
2. Locking or restrained joint gaskets for “push-on” joint ductile iron pipe shall be standard SBR gaskets with high strength stainless steel wedging elements equally spaced around the gasket for restraining action. Locking gasket fittings shall comply with ANSI A21.11 and A21.53, and AWWA C111 and C153, and shall be ANSI/NSF Standard 61 certified for contact with potable water.
3. Full-face or ring gaskets for flanged ductile iron pipe shall be manufactured of Styrene Butadiene Rubber (SBR) conforming to the material requirements of ANSI A21.11 and AWWA C111, and shall be ANSI/NSF Standard 61 certified for contact with potable water.

F. Externally Restrained Joints

1. Externally restrained joints for pipe sizes four inches (4") to twenty inches (20") shall be mechanical joints with ductile iron “Mega-Lug” or approved equal with a minimum working pressure of three hundred and fifty pounds per square inch (350 psi).
2. Joints shall typically be externally restrained in areas where thrust restraint is required or where fittings are installed, except where another type of restraint is shown and approved on the construction drawings or in the Special Conditions.
3. Length of restraint shall be determined by the Project Engineer.
4. Mechanical joint restraint shall be constructed of ASTM A536 ductile iron and shall conform to ANSI A21.10, A21.11 and 21.53, and AWWA C110, C111, and C153.
5. Mechanical joint restraint shall be equipped with torque limiting twist off nuts.

G. Flexible Couplings

1. Flexible Couplings for ductile iron pipe shall be mechanical joint sleeves or Dresser Couplings, Style 38, as shown on the approved construction drawings.
2. Couplings shall be properly sized for the pipes on which they are used.

H. Linings and Coatings

1. All ductile iron pipe and fittings shall have a standard cement lining complying with ANSI A21.4.

2. Pipe and fittings to be installed underground shall be asphaltic coated in accordance with ANSI A21.4.
 3. Above ground exposed piping shall be thoroughly cleaned of all dirt, mill scale, or rust and prime coated with Tnemec 77 or equivalent coating approved by the Water Works Board of the City of Auburn and the Project Engineer.
- I. Copper Tubing
1. Copper tubing shall be soft annealed Type K and shall comply with Federal Specification WW-T-799.
 2. Copper tubing shall be used for all one inch (1") and two inch (2") service lines.
- J. Drain Pipe
1. Drain pipe shall have a minimum three inch (3") diameter and shall be of the type shown on the construction drawings.
- K. Exposed Outside Pipe
1. Exposed outside piping shall be insulated to prevent freezing where specifically shown on the construction drawings. Insulating materials shall be one inch (1") thick Armaflex 22 sheet flexible foam plastic with closed cellular structure as manufactured by Armstrong Industry Products and galvanized steel bands.
 2. After installation the insulation shall be coated with Armstrong Armaflex Finish (vinyl lacquer coating), or approved equal.
- L. Strainers
1. Strainers to be installed before water meters one and one-half inches (1½") and larger shall be Neptune or approved equal. Bodies shall be epoxy coated steel suitable for one hundred and fifty pounds per square inch (150 psi) working pressure. Screens shall be stainless steel.

14.05 VALVES

- A. Gate Valves - Two Inch (2") Diameter and Larger
1. Gate valves two inches (2") in diameter or larger shall be iron-body, bronze mounted, inside-screw, hand-operated resilient seat, with non-rising stems, and shall be equipped with rubber O-Ring Seals at the top of the stems unless otherwise shown on the construction drawings.
 2. Valves shall conform to the requirements of AWWA Specification C500, except as such specifications are herein modified.
 3. Gate valves shall be designed for minimum working pressure of two hundred pounds per square inch (200 psi).
 4. Gate valves shall be as manufactured by Mueller Company, M & H division of Dresser Industries, American Darling Division of ACIPCP or approved equal.

5. Two inch (2") diameter valves shall have threaded connections unless shown otherwise on the construction drawings.
 6. Valves three inches (3") in diameter and larger, shall have mechanical joints for use underground and shall have flanged joints if they are to be installed in structures. Flanges for all pressure ratings shall be faced and drilled to comply with ANSI Specifications A21.15.
 7. Gate valves shall be hand operated and designed to turn left or counter-clockwise to open.
 8. Valves installed underground shall have operating units.
 9. Exposed valves shall have hand wheels or manual floor stands as shown on the construction drawings.
 10. Suitable extension stems or operating keys shall be furnished to properly operate all valves installed with valve boxes, and all necessary guides and supports for valve stems shall be furnished and installed where required.
 11. All gate valves installed underground shall be equipped with standard cast iron valve boxes unless otherwise shown on the construction drawings.
 12. Where valves are shown to be of smaller diameter than the connecting piping the two reducers required shall be included as fittings.
 13. The Contractor shall submit to the Water Works Board of the City of Auburn and the Project Engineer complete catalog information showing principal dimensions, weights, and specifications and operating data for all valves.
- B. Gate Valves - Less than Two Inch (2") Diameter
1. Gate Valves smaller than two inches (2") in diameter shall be Class 150, or Class 200, as shown on the construction drawings. Where not specifically shown on the construction drawings, gate valves shall be Class 150.
 2. Valves shall be of all bronze construction with rising stems.
 3. Class 150 valves shall be Crane Co., No. 431 UB; Class 200, Crane Co., No. 424, or approved equal.
 4. Small gate valves shall be installed with all pipe connections and fittings necessary to serve the purpose intended.
- C. Butterfly Valves - Sixteen Inch (16") Diameter and Larger
1. Butterfly valves shall be tight closing rubber-seated valves that comply with all requirements of AWWA Specification C504, latest revisions.
 2. Valves shall be suitable for throttling service, frequent operation, or operation after long periods of inactivity.
 3. Except when shown otherwise, valves shall be Class 150 B.

4. When requested, the manufacturer shall furnish the Water Works Board of the City of Auburn and the Project Engineer an "Affidavit of Compliance" with AWWA Specification C504, latest revision.
 5. Butterfly valves shall be as manufactured by Henry Pratt Co., Dresser Industries, American Darling Valve division of ACIPO, Clow Corp., or approved equal.
 6. Valves bodies shall be cast iron or ductile iron complying with ASTM A126, Class B. Valves to be installed underground shall have mechanical joint ends; exposed valves shall have flanged ends conforming to ANSI B16.1, Class 125. Where the rubber seat is mounted on the vane, the body shall be fitted with a 360-degree stainless steel seat offset from the shaft, mechanically retained.
 7. Valve discs shall be constructed either of alloy cast iron ASTM A436, Type 1 (Ni-Resist) or of ductile iron ASTM A536 Grade 65-45-12. Where the rubber seat is mounted in the body, the mating edge of the disc shall be 18-8 stainless steel, Type 304 or Type 316.
 8. Valve shafts shall be turned, ground, and polished. Shafts shall be constructed of 18-8, Type 304 stainless steel. Shafts may be one-piece units that extend full size through the valve disc or the stub type for use with solid ductile iron discs.
 9. Valve seats, either natural rubber or synthetic rubber, shall be installed on either the valve disk or valve body. Seats installed on the valve disk shall be mechanically retained. Seats in valves in twenty inches (20") and smaller sizes may be vulcanized to the body or mechanically retained. Seats vulcanized to the body shall withstand a seventy-five pound (75 lb.) pull under test procedure ASTM D429, Method B.
 10. Valve bearings shall be the sleeve type, corrosion resistant, and self-lubricating. Bearing load shall not exceed one-fifth (1/5) that of the compressive strength of the bearing or shaft material and shall not exceed two thousand five hundred pounds per square inch (2,500 psi).
 11. Valve interior surfaces, except seating surfaces, shall be evenly coated with a suitable primer to inhibit rust or a black asphalt varnish.
 12. Valve operators shall be suitable for underground service and shall be fully gasketed, grease packed, watertight, and shall be provided with extension stem and operating nut, cast iron valve box, and tee wrench for opening and closing valves. Valves shall close in a clockwise rotation of the stem.
- D. Small Ball (Less than Two Inch Diameter)
1. Ball valves smaller than two inches (2") in diameter shall be lever operated valves with bronze bodies and trim and with end connections suitable for installation as shown on the construction drawings.
 2. Valves shall be Clincher model as manufactured by Jamesbury Corp., or Accasso Model as manufactured by Crane Co., or approved equal.

E. Valve Boxes

1. All valves installed underground shall be provided with a cast iron valve box to house and protect the valve stem.
2. Valve boxes shall be of the adjustable screw type with a shaft diameter of five and one-fourth inches (5 ¼").
3. The base shall be round or oval.
4. The box shall be provided with an extension section so that when installed the cover will be slightly above ground surface (approximately ½").
5. All valve boxes installed in unpaved areas shall have a concrete collar installed according to the standard details. Where a precast collar is installed, the annular space between the valve box and the concrete collar shall be grouted in.
6. Ductile iron or cast iron pipe shall not be used as valve box extension unless approved. PVC should never be used as a valve box extension.
7. In quality, design, and weight, all valve boxes and covers shall be, Mueller No. H-10364 or No. H-10380, or M & H No. E-2702 or E- 3102 or an approved equal.

F. Automatic Air Release Valves

1. Air release valves shall be air/vacuum valve type and shall be furnished and installed in the sizes shown on the approved construction drawings.
2. Air release valves shall have a minimum working pressure of one hundred and seventy five pounds per square inch (175 psi), shall be tested at three hundred pounds per square inch (300 psi).
3. Air release valves shall be designed to automatically release air during filling and admit air during draining operations.
4. Air release valves shall be equipped with a polypropylene float and a rolling seal mechanism.
5. Air release valves shall be as manufactured by ARI or approved equal.
6. Air release valves shall be installed in a standard meter box in accordance with the standard details.
7. An isolation valve shall be provided at the connection point.

14.06 PRESSURE REGULATORS

A. General

1. Water pressure regulators shall be of the diaphragm type furnished with stainless steel strainers (except when a filter is required) and shall be of the sizes shown on the approved construction drawings.
2. Each regulator shall be suitable for a maximum inlet pressure of two hundred and fifty pounds per square inch (250 psi) and the outlet pressures shown on the approved construction drawings.

3. Outlet pressure settings shall be adjustable.
4. Pressure regulators shall be manufactured by Watts, Cla Val, Bermad, or approved equal.

14.07 PRESSURE GAUGES

- A. General
1. Pressure gauges for piping or pumps shall be liquid filled, of the Bourdon Tube type having phosphor bronze or stainless steel tubes, aluminum cases, and steel rings.
 2. Cases and rings shall be finished in black enamel.
 3. Dials shall be three and one-half inches (3-1/2") in diameter.
 4. Gauges shall be Figure No. 5001, as manufactured by U.S. Gauge Co., or Type 1 as manufactured by Marsh Instrument Co., or Figure No. 23 as manufactured by Marshalltown Manufacturing Company, or approved equal.
 5. Each gauge shall be installed with one-fourth of an inch (1/4") brass pipe, complete with gauge cock and Ray Pressure Snubber.

14.08 FIRE HYDRANTS

- A. General
1. All fire hydrants shall conform to the requirements of AWWA Specification C502, except as such specification is modified herein.
 2. Fire hydrants shall be Mueller Centurion or American Darling Model B84B, traffic type hydrants.
 3. Fire hydrants shall be furnished with two (2) hose connections each two and one-half inches (2-1/2") in diameter and one (1) four and one-half inch (4-1/2") diameter pumper connection, unless approved otherwise.
 4. The valve openings shall be five inches (5") and the standpipe shall be six inches (6") inside diameter, unless approved otherwise.
 5. Hydrants shall be designed for mechanical joint connections unless otherwise approved.
 6. Unless otherwise directed by the Water Works Board of the City of Auburn and the Project Engineer, the nozzles and caps shall be chased to National Standard hose and steamer nozzle threads (see B-26-1925, with latest revisions).
 7. Hydrants shall be equipped with safety flanges.
 8. Hydrants shall be designed to open by turning the operating nut left, or counter-clockwise. An arrow and the word "OPEN" shall be cast in relief on the top of the hydrant to designate the direction of opening.

B. Installation

1. The buried length of each hydrant shall be suitable for operating under the conditions shown on the approved construction drawings and shall be the vertical distance from the bottom of the connecting pipe to the ground line of the hydrant when installed.
2. Hydrants shall have no more than one (1) riser installed, and said riser shall be no more than twelve inches (12") in height unless otherwise approved.
3. The outside of the top section of the hydrant shall be thoroughly cleaned and given a coat of primer per AWWA C502, and a second coat of yellow high gloss machinery enamel. The Contractor shall repaint hydrants after installation if the paint is damaged or the appearance marred by handling.

14.09 SERVICES

A. New Service Connections

1. Service connections and lines shall be installed as shown on the approved construction drawings and/or as specified in the Special Conditions.
2. New services installed shall be a minimum of one inch (1") diameter.

B. Existing Service Connections

1. Existing services that are to be abandoned or terminated as part of the project shall be disconnected at the distribution system main line at the full expense of the Contractor unless otherwise approved by the Water Works Board of the City of Auburn.
2. In no case are existing services to be crimped, clamped, or inadequately sealed for permanent abandonment, but shall be completely severed from the distribution system and appropriately sealed off utilizing a corporation stop, valve, sleeve, restrained plug, or other prescribed method approved by the Water Works Board of the City of Auburn to prevent future leakage.
3. Any existing services that have been omitted or not accurately shown on the construction drawings are notwithstanding from this requirement should they be discovered on the project site. It is the responsibility of the Contractor to locate all existing services prior to beginning construction.

14.10 METERS

A. General

1. Meters shall be of the size and type as shown on the approved construction drawings and as specified in the Special Conditions.
2. Meters shall be manufactured by Neptune and shall be equipped with R-900 radio read systems attached to the lid.
3. Developments requiring meters that are one and one-half inches (1 ½") and larger or more than six individual three-fourth of an inch (¾") meters

shall install the meters in a precast or cast in place vault per the standard details.

4. No more than twelve individual meters shall be installed in a single vault.

14.11 VAULTS

A. General

1. Vaults shall be of the size and type as shown on the approved construction drawings and specified in the Special Conditions
2. The appurtenances in and around a vault shall be arranged according to the appropriate standard detail for the purpose in which the service and vault is intended.

B. Concrete

1. Vaults may be pre-cast or cast-in-place concrete.
2. Concrete shall be Class "A", four thousand pounds per square inch (4000 psi) concrete mix with steel wire and bar reinforcement in accordance with the provisions in Section 11 of these specifications.
3. All openings in the concrete for piping and appurtenances shall be appropriately grouted and sealed to ensure water tightness in the vault.
4. All vaults shall have steel reinforced polypropylene steps mounted in the concrete.

C. Hatch

1. The hatch shall be aluminum construction rated for a minimum of three hundred pounds per square foot (300 lb/sf) loading.
2. All hardware shall be Type 316 stainless steel.
3. The hatch shall be equipped with an automatic hold-open door device, water tight slamlock, and removable key wrench.
4. The frame and cover shall be cast into the concrete and shall be flush with the top of the concrete.
5. The hatch shall span the entire length and width of the vault to provide maximum opening access to the interior of the vault.
6. The hatch shall be manufactured by U.S. Foundry, Bilco, or approved equal.

D. Dimensions

1. Vaults shall be of adequate size to allow a minimum of one foot (1') spacing around all appurtenances, and between paralleling appurtenances for maintenance and repair.
2. The specific vault dimensions shall be in accordance with the applicable standard details.
3. The top of the vault shall be no more than six inches (6") above finish grade.

4. Vaults shall be placed at an adequate distance from any other utility lines or structures to allow safe excavation for any needed repairs.
 5. Vaults shall be no more than six feet (6') deep and shall have no additional pre-cast riser sections added without prior approval by the Water Works Board of the City of Auburn.
- E. Drain
1. All vaults are required to acquire positive drainage from the vault through a floor drain to grade or to a storm sewer collection system.
 2. The drain shall be a minimum three inches (3") in diameter and cast into the floor.
 3. The floor of the vault shall be constructed to drain to the opening.
 4. No sidewall drains are permitted.
 5. The vault shall be placed on No. 57 stone or larger at a minimum depth of six inches (6").
 6. If it is demonstrated that positive drainage cannot be acquired approval may be given on a case by case basis to construct a "false bottom" of No. 57 stone or larger. The volume of the stone under the vault shall then be greater than or equal to the volume of the vault, and shall be at a minimum twelve inches (12") deep and extend a minimum of twenty four inches (24") from all sides of the vault.
- F. Piping and Fittings
1. All piping and fittings inside the vault shall be flanged ductile iron.
 2. All external piping around the vault shall be mechanical joint with Mega-Lug retainer glands, or approved equal.
 3. All piping and assemblies shall be centered in the vault.

14.12 BACKFLOW PREVENTION ASSEMBLIES

- A. General
1. Backflow protection shall be required on all service connections to the Water Works Board of the City of Auburn's potable water distribution system in accordance with the Backflow Prevention and Cross-Connection Control Policy of the Water Works Board of the City of Auburn.
 2. Backflow prevention assemblies shall be of the size and type shown on the construction drawings or specified by Water Works Board of the City of Auburn for the appropriate degree of hazard of a backflow incident.
 3. Backflow protection devices shall be manufactured by Ames, Watts, or approved equal.
- B. Dual Check Valve (DCV)

1. Shall be installed in a standard meter box directly behind all meters that are one inch (1") in diameter and smaller according to the standard details.
- C. Double Check Backflow Assemblies (DCBA)
1. Shall be installed below grade in a vault in accordance with the standard details.
 2. The DCBA device shall meet AWWA C510-97 (latest revision) and be approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California, as well as all local plumbing codes.
- D. Reduced Pressure Backflow Assemblies (RPBA)
1. Shall be installed in an above ground enclosure system according to the standard details such as a Hydrocowl, Hot Box, Lok Box, or approved equal.
 2. The RPBA device shall meet AWWA C511-97 (latest revision) and be approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California, as well as all local plumbing codes.
- E. Fire Protection Systems
1. Backflow prevention assemblies on non-metered flow such as isolated fire protection systems shall be equipped with detector check meters in the assembly.
 2. On metered fire protection systems that require sprinkler protection; backflow prevention shall be installed before the Fire Department Connection for each individually isolated sprinkler system.
- F. Testing and Certification
1. Following installation, all DCBAs and RPBA's are required to be tested by a certified backflow prevention assembly tester in accordance with the Backflow Prevention and Cross-Connection Control Policy of the Water Works Board of the City of Auburn within ten (10) days. The test results shall be submitted on an approved Water Works Board of the City of Auburn form.

14.13 CONSTRUCTION METHODS

- A. General
1. Pipe and accessories shall be handled in such a manner as will insure delivery to its final position on the work in an undamaged condition. Pipe coating and lining shall be carefully protected.
 2. The inside of each section shall be thoroughly cleaned just before it is placed in final position, and shall be kept clean and free of water during laying operations.
 3. No pipe shall be laid in water or when the trench or other conditions are unsuitable for such work.

4. Water shall be kept out of the pipe trench until the pipe has been laid and the joints are completed.
5. All pipe shall be inspected just before it is placed in final position and rung with a light hammer to detect defects.
6. Any pipe or accessories found to be defective, damaged or otherwise unsuitable for the purpose either before or after its installation shall be removed by the Contractor and replaced with acceptable pipe at Contractor's expense.
7. The spigot end of each piece shall be examined for burrs that could damage a gasket.
8. The cutting of pipe for closure pieces or for other purposes shall be done in a neat and workmanlike manner, without damage to the pipe; by the use of a wheel cutter or other approved type of mechanical cutter
9. No pipe shall be laid in trenches where the depth of cover will be less than thirty inches (30") unless otherwise shown on the approved construction drawings or approved by the Water Works Board of the City of Auburn and the Project Engineer.
10. Pipes ten inches (10") and larger shall have minimum thirty six inches (36") cover.
11. Water mains shall typically be installed with the specified minimum covers unless otherwise approved by the Water Works Board of the City of Auburn.
12. Water mains shall not exceed depths of cover greater than eight feet (8') under any circumstances.
13. Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.
14. Whenever existing utility structures or branch connections leading to main sewers or to main drains, or other conduits, ducts, pipes, or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated, or reconstructed by the Contractor through cooperation with the Owner of the utility, structure, or obstruction involved.
15. All pipe shall be laid and maintained to the required lines and grades; with fittings and valves at the required locations; and with joints centered and spigots home; and with all valve stems plumb. When in final position the invert of the pipe shall be at the exact elevation and grade shown on the approved construction drawings.
16. Water lines generally will be installed so that they would cross over the top of the storm sewer and sanitary sewer pipes.
17. Water mains shall be separated from storm sewer mains and structures by a minimum of twenty four inches (24") horizontally and six inches (6")

vertically. In no case will a water main be allowed inside a storm sewer structure.

18. Water mains shall be separated from sanitary sewer mains and structures by a minimum of ten feet (10') horizontally and eighteen inches (18") vertically.
19. No deviation shall be made from the required line or grade except with the consent of the Water Works Board of the City of Auburn and the Project Engineer.

B. Laying Pipe

1. Each piece of pipe shall be placed in the trench with the full length of the barrel resting upon the prepared bedding and with the bell over a bell hole excavated at the proper place to accommodate the bell and permit preparation of the joint.
2. Where angular deflections are necessary due to vertical or horizontal curves, the maximum allowable deflection for "push-on" joints, measured between the center lines extended, shall be five degrees (5°) for twelve inch (12") and smaller sizes, and three degrees (3°) for fourteen inch (14") and larger sizes. Where greater total deflection is required than can be obtained using factory standard lengths, the Contractor shall cut the pipe and install shorter lengths or install appropriate degree bends.
3. Except where necessary to make connections with other lines, pipes shall be laid with the bell facing the direction of lying. For lines on an appreciable grade the joints shall be faced upgrade.
4. After each piece of pipe has been lowered into the trench and before jointing operations are started, all lumps, blisters and excess coating materials shall be removed from the surfaces to be joined and the outside of the spigot end and the inside of the joint shall be wire brushed, wiped clean and dry, and all oil and grease removed. The cleaning operation shall be repeated, if necessary, just prior to making the joint. File spigot ends to remove burns.
5. The fittings at all bends in underground pressure lines shall be securely anchored to prevent the fittings from blowing off when under pressure.
6. Where pipe ends are dead-ended to permit future connections they shall be valved, plugged, or capped and appropriately restrained. Three (3) joints of pipe are required between the valve and the plug/cap. If the distance available is not sufficient to allow for three (3) joints of pipe, the valve, plug, and previous joints of pipe must be restrained using external restraint mechanisms or a concrete deadman in accordance with the standard details.
7. Connections between new and old lines and between different kinds and types of pipe shall be made with standard or special fittings to suit the actual conditions and shall be made in a neat and workmanlike manner acceptable to the Water Works Board of the City of Auburn and the Project Engineer.

8. Mechanical and "push-on" joints for ductile iron pipe and fittings shall be installed in strict accordance with the recommendations of the manufacturer.
9. Bell holes shall be of sufficient size to allow ample room for properly making the pipe joints. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length.
10. After the joints have been completed the Project Engineer or the Inspector shall inspect them before they are covered up. Any leaks or defects discovered at any time after the completion of the work shall be repaired immediately.
11. All pipe in place shall be carefully protected from damage until backfilling operations have been completed.
12. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. The Contractor shall not open at any time more trench than his available pumping facilities are able to dewater.
13. Backfilling of trenches shall be started immediately after the pipe is in place and the joints completed and inspected by the Project Engineer or inspector.
14. The Contractor shall place a vertical piece of two inch (2") PVC pipe at all bends, fittings, elevation transitions, and at a minimum of every one hundred feet (100') along the water main for the purpose of attaining the vertical elevation of the pipe at the time the "as-built" drawings are surveyed. The contractor shall also be responsible for removing or abandoning the PVC pipes upon approval of the "as-built" drawings by the Water Works Board of the City of Auburn.

C. Bore Installation

1. Where road borings are required, they shall typically be a traditional jack-and-bore construction method using a steel casing unless otherwise approved by the Water Works Board of the City of Auburn for directional drilling methods to be used.
2. All bores for water mains and services shall be aligned and delivered precisely to the location shown on the construction drawings to minimize additional fittings required at the main connection.
3. The carrier pipe shall be pressure class 350 ductile iron, and the pipe joints shall be restrained using external restraint mechanisms or locking gasket restraints.
4. The carrier pipe shall be encased in welded steel pipe, having a minimum wall thickness of one-fourth of an inch (1/4") in accordance with Table 14.13.1.
5. Tracts, guides, or supports shall be used to convey the carrier pipe through the encasement.

6. The steel casing shall have an inside diameter at least six inches (6") more than the outside diameter of the pipe bell.
7. The casing shall be sealed at each end with rubber boot and double band stainless steel straps to prevent any water or other materials from entering the encasement.
8. Where possible, the steel casing shall extend at least five feet (5') beyond the edge of the roadway or planned roadway widening, but shall in no case continue within five feet (5') of a water main connection, fitting, or valve.
9. Where water service connections are being made, the existing water main shall be excavated as part of the receiving pit, prior to setting up the bore, to verify the necessary depth and grade shown on the construction drawings.
10. All other utilities shall be located and potholed, where necessary, prior to performing the bore.
11. Table 14.13.1 outlines the minimum casing sizes based on the carrier pipe size:

Table 14.13.1

Carrier Pipe		Steel Casing		
Nominal Pipe Diameter	Standard Pipe Bell O.D.*	Casing Spacer Band Width	Minimum Casing Thickness	Minimum Casing Inside Diameter**
4	6.4	8	0.25	14
6	8.6	8	0.25	16
8	11.16	8	0.25	18
10	13.25	8	0.25	20
12	15.22	8	0.25	22
14	17.73	12	0.25	24
16	19.86	12	0.3125	26
18	22.16	12	0.3125	30
20	24.28	12	0.3125	32
24	28.5	12	0.3125	36
30	34.95	12	0.5	42
36	41.37	12	0.5	48

All sizes are indicated in inches.

*Pipe bell outside diameter based on Pressure Class 350 ductile iron pipe.

**Casing inside diameters are based on being a minimum of 6 inches greater than the outer diameter of the joint bell, to the nearest even inch.

D. Flanged Ductile Iron Pipe

1. Flanged pipe shall be installed in accordance with the recommendations of the manufacturer.
2. The faces of the flanges on two adjacent sections shall be carefully centered and the sections adjusted to proper line and grade before the flange bolts are tightened.

3. Gaskets shall be placed in position without damage. Any gasket damaged in the process shall be discarded. They shall be attached to the flange by rubber gum before the joint is made up in a manner that will prevent displacement.
 4. After the pipes have been properly centered and adjusted to true line and grade they shall be firmly bolted together, care being taken to tighten all nuts uniformly around the flange with a torque wrench to 75-95 ft/lbs or as otherwise recommended by the manufacturer.
 5. Suitable flanged wall fittings or thimbles shall be used where pipes pass through walls of structures.
- E. Setting Valves, Valve Boxes, Fittings, and Blow-offs
1. Gate and butterfly valves and pipe fittings shall be set and connected to the pipe in the manner heretofore specified for cleaning, laying and jointing pipe.
 2. Cast-Iron valve boxes shall be installed on all underground valves and shall be firmly supported, centered, and plumbed over the operating nut, with box cover flush with finished pavement or slightly above ground surface (approximately ½") in non-paved areas, unless otherwise directed.
 3. Valve boxes shall be installed on a firm base at the proper elevation and then carefully backfilled and tamped.
 4. After final backfill has been installed and approved by the Project Engineer, a concrete collar as shown on the standard details shall be installed around each valve box. The annular space between precast collars and valve box shall be grouted in.
 5. Valve boxes set in paved areas shall be erected with the top flush with the surface of the pavement in an approved traffic rated enclosure. In its final position the box shall not touch the valve stem at any point.
 6. Ductile iron or cast iron pipe shall not be used as a valve box extension unless approved. PVC should never be used as a valve box extension.
 7. Drainage branches or blow-offs shall not be connected to any sewer or submerged in any stream or be installed in any other manner that will permit back-siphonage into the distribution system.
- F. Setting Fire Hydrants
1. All fire hydrants shall be set plumb and shall conform to the established grade.
 2. The center of nozzles shall be between sixteen inches (16") and twenty inches (20") above ground surface.
 3. Wherever hydrants are set in impervious soil, a drainage pit two feet (2') in diameter and two feet (2') deep shall be excavated below each hydrant and filled compactly with coarse gravel or crushed stone under and around the bowl of the hydrant and to a level six inches (6") above the waste opening. Hydrant drainage pits shall not be connected to a sewer.

4. The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with concrete backing, or it shall be tied to the pipe by other means shown on the construction drawings or authorized by the Project Engineer.

G. Thrust Restraint

Thrust restraint will be required for all water lines four inches (4") or larger where unbalanced forces exist. This shall include all ends of main locations where plugs or caps are installed and all changes in size or direction where fittings such as reducers, tees, horizontal bends, vertical bends, etc. are installed. Generally, areas needing thrust restraint shall be minimized by utilizing pipe deflection in lieu of additional bends and fittings. Where required, thrust restraint shall adhere to the practices outlined in the DIPRA Manual for Thrust Restraint design for ductile iron pipe and the City of Auburn standard details. Non-standard thrust blocking will require special detailing provided by a licensed engineer and approved by the Water Works Board of the City of Auburn.

1. Restrained Joint Devices

- a) The preferred method of thrust restraint is through the use of externally restrained joint devices such as "Mega-Lug" or approved equal in lieu of concrete blocking.
- b) All thrust restraint shall be adequately calculated by the Project Engineer and installed as shown on the construction drawings.
- c) The exact linear footage of restraint shall be measured from the flange of the fitting which is being restrained.

2. Concrete Blocking

- a) Where approved, reaction or thrust backing of Class "B" Concrete in accordance with Section 11 of these specifications may be applied on pressure pipe lines up to twelve inches (12") in diameter in lieu of restrained joint devices.
- b) All tees, plugs, caps and bends shall be wrapped in plastic prior to pouring concrete.
- c) Plastic shall be four (4) mil minimum high-density polyethylene or eight (8) mil minimum low density polyethylene, per AWWA C105.
- d) The thrust bearing sides of all concrete blocking shall be poured against firm undisturbed soil and the non-thrust bearing sides shall be formed at an angle to the undisturbed soil.
- e) Restraint using metal harnesses, tie rods, pipe clamps, etc. anchored by concrete blocking shall only be used where approved and shown on the construction drawings. Steel rods and clamps shall be of an approved design, galvanized or otherwise rustproof treated, or shall be painted as directed by the Project Engineer.

H. Connection to Existing Mains

1. Except when shown otherwise on the construction drawings, connections to existing water mains shall be made by cutting and removing a portion

of the existing pipe and inserting a standard mechanical joint tee (or cross) and a sleeve.

2. At locations shown on the construction drawings, connections to existing mains shall be made by installing tapping sleeves and valves.
3. Connections must be two inches (2") smaller than existing main when utilizing a stainless steel tapping sleeve.
4. Ductile iron tapping sleeves may be approved on a case by case basis for same size taps.
5. All connections to live mains must be done with a City of Auburn or Water Works Board Inspector present.
6. No taps smaller than one inch (1") shall be permitted.

14.14 TESTING

A. Hydrostatic Pressure Test

1. All newly installed pressure pipe, or any valved section thereof, shall be subjected to a hydrostatic test at a pressure one and one-half (1-1/2) times the working pressure at the point of testing, but not less than one hundred and fifty pounds per square inch (150 psi).
2. The pipe shall hold the test pressure for a minimum of two hours (2 hrs) with a leakage of no more than five pounds per square inch (5 psi) and shall be recorded on a Bristol Babcock pressure gauge chart.
3. The test shall be conducted at the point directed by the Inspector, Project Engineer, or Owner. The contractor at his own expense shall install the test point.
4. Each valved section of pipe shall be slowly filled with clean water and the specified pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, meters and other apparatus required for the tests shall be furnished and installed by the Contractor.
5. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation, and afterward tightly plugged or converted to permanent manual air release valves.
6. All exposed pipes, fittings, valves, and joints shall be carefully examined. All leakage in joints shall be completely stopped.
7. Any cracked or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor with sound material in the manner herein before provided and the test shall be repeated until satisfactory to the Project Engineer.
8. Should any test of combined section of pipe disclose leakage, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage has been completely stopped.

B. Disinfection

1. Completed potable water mains shall be disinfected with chlorine after the mains have been flushed but prior to being placed in service.
2. Each valved section of pipe shall be thoroughly flushed at a rate of at least five feet per second (5 fps), independently, and all dirt and foreign matter shall be removed. Flushing shall be done after pressure testing and either before or after the trench has been backfilled.
3. The Contractor shall pump a solution of calcium hypochlorite (HTH) into the pipe, with the Inspector present, in a manner that will result in a concentration of chlorine of at least fifty parts per million (50 ppm) throughout the pipe.
4. The solution shall remain in the pipe for at least twenty four (24) hours to kill all non-spore forming bacteria, and after twenty four (24) hours the concentration shall be at least twenty five parts per million (25 ppm) in all parts of the pipe
5. All valves shall be operated and services flushed while the pipe contains the chlorine solution, before the twenty four (24) hour contact time clock is started.
6. After disinfection is complete, the chlorinated water shall be flushed from the pipe at its extremities until the replacement water shall, by test, be proven to be safe for human use.
7. The Inspector shall submit water samples, for bacteriological examination to the State Health Department Laboratory, from water mains after chlorination.
8. Should the initial treatment prove ineffective, the procedure shall be repeated until confirmed tests show that water sampled from the pipe conforms to the above requirements.

14.15 MAINTENANCE

The Contractor shall maintain all street and road surfaces, trench backfill and all completed sections of pipelines in good condition until final acceptance of all work by the Water Works Board of the City of Auburn.

The Water Works Board of the City of Auburn may use completed sections of the water mains when needed. However, such use shall not relieve the Contractor of his responsibility for maintaining or replacing defective work.