Board of Water and Sewer Commissioners
of the
City of Mobile, Alabama

Update of Standard Specifications
Section 11

Potable Water Utilities Standard Specifications

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PART 1 GENERAL

11.1.01 SCOPE

A. These general and detailed Specifications form a part of the Contract Documents and shall govern the handling and installation of water piping, valves, hydrants and accessories described herein, and as shown on the accompanying Plans. See Appendix A for Standard Details pertaining to this Section.

11.1.02 WORK INCLUDED:

A. All labor, equipment and material necessary to complete the Work as stipulated herein. The Contractor shall establish appropriate traffic control measures; maintain access for local and emergency vehicles where required; remove as much of the pavement as may be necessary; excavate the trenches and pits to the required dimensions; excavate the bell holes, construct and maintain sheeting, bracing, and support the adjoining ground or structure where necessary; handle all drainage or ground water; guard the site; unload, haul, distribute, lay and test the pipe, fittings, valves, hydrants and accessories; rearrange the branch connections to main sewers, or rearrange other conduits, ducts, or pipes where necessary; replace all damaged drains, sewers, or other structures; backfill the trench and pits; restore the roadway surface unless otherwise stipulated; remove surplus excavated material; clean the site of the Work; chlorinate the completed pipeline, and have samples checked and approved for bacteriological analysis by the State Board of Health or other regulatory agency and maintain the street or other surface over the trenches, perform hydrostatic testing and flushing the completed pipeline, plus any other tasks necessary to properly achieve the intended objectives of the project. All work shall comply with all local, state and federal regulations applicable to the work.

11.1.03 REVISIONS

A. These specifications will be modified and updated as required to keep abreast of current technologies, industry standards, regulatory agency requirements, and best management practices. It shall be the responsibility of the end user of these Guide Specifications to insure the latest and most current revision is applied to the project.

11.1.04 REFERENCED SECTIONS

A. Section 7 - Legal Relations and Responsibility to Public

B. Section 10 - Special Provisions

C. Section 14 - Removing and Replacing Pavement

D. Section 15 - Backfilling

E. Section 16 - Erosion Control

F. Section 17 - Encasement Pipe

G. Appendix A – List of Acceptable Products and Approved Manufacturers

H. Board Policy and Procedure Manual

11.1.05 REFERENCED CODES AND STANDARDS

A. ASTM A536 – Standard Classification for Ductile Iron Castings

B. ANSI/AWWA A21 – Standard for Flanged Ductile-Iron Pipe with Threaded Flanges

C. ANSI/AWWA C153/A21 – Ductile-Iron Compact Fittings

D. ANSI/AWWA C111/A21.11 – Rubber-Gaskets Joints for Ductile-Iron Pressure Pipe and Fittings

E. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and fittings

F. AWWA C105 - Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids

G. AWWA Manual M31 - Distribution of System Requirements for Fire Protection

H. AWWA Specification C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water

I. AWWA C-600 – Installation of Ductile-Iron Mains and Their Appurtenances

J. AWWA C110 – Flanged Fittings

K. AWWA C153 – Mechanical Joint Ductile Iron Fittings

L. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 60 in. (100 mm Through 1,500mm)

M. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe 14” Through 36” for Water Transmission and Distribution Pipe

N. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

O. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

P. ANSI/AWWA C153/A2153 – American National Standard for Ductile-Iron compact Fittings for Water Service

Q. AWWA C304 - Design of Prestressed Concrete Cylinder Pipe

R. AWWA C301 – Prestressed Concrete pressure Pipe, Steel-Cylinder Type

S. ASTM A648 – Standard Specification for Steel Wire, Hard-Drawn for Prestressed Concrete Pipe

T. ASTM A370 – Standard Test Methods and Definitions for Mechanical Testing of Steel Products

U. AWWA C207 Class D – Steel Hub Flange

V. AWWA M9 - Manual for Concrete Pressure Pipe

W. AWWA C210 – Liquid-Epoxy Coating and Linings for Steel Water Pipe Fittings

X. AWWA C500 – Standard Double Disc Gate Valves

Y. AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

Z. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service

AA. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

BB. AWWA C105 - Standard for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids

CC. ASTM A126 – Standard Specification for Gray-Iron Castings for Valves, Flanges, and Pipe Fittings

DD. ASTM A48 – Standard for Gray Iron Castings

EE. AWWA C504 – Butterfly Valve

FF. AWWA C-502 – Dry-Barrel Fire Hydrants

GG. ANSI B16.1 – Cast Iron Flange Fittings

HH. AWWA C800 – Underground Service Line Valves and Fittings

II. AWWA C651. – Disinfecting Water Mains

JJ. AWWA B300 – Standard for Hypochlorite

11.1.06 MATERIALS

A. Ductile Iron Pipe: Ductile iron pipe for water lines shall meet the latest requirements of AWWA Specification C151 with mechanical joint or push-on joint unless specifically shown otherwise on the Plans. Working pressure shall be a minimum of 150 psi. Design pressure classes are listed below:

1. 4”- 12” diameter (Class 350)

2. 14” – 24” diameter (Class 250)

3. 30” – 54” diameter (Class 150)

B. The interior of all pipe shall be cement mortar lined as specified in AWWA Specification C104 and the exterior shall receive an approved bituminous coating. All gaskets, bolts and lubricants shall be furnished.

C. Ductile iron pipe shall be centrifugally cast with minimum wall thickness in accordance with AWWA C151, Table 51.1, except where shown otherwise on the Plans and/or Specifications. If it is necessary to cut ductile iron pipe, in no case shall it be cut by burning. Cutting of ductile iron pipe shall be by saw, cutter, abrasive wheel or other approved means. When cutting ductile iron for jointing to bells, fittings, and valves, the pipe shall be cut square with the centerline of the pipe. Jagged, irregular cuts or cuts at angles to the center line of the pipe will be rejected. The lining of the pipe shall not be damaged by the cutting process. Cut ends

and rough edges shall be ground smooth. For push on joints, the cut end shall be beveled and coated in accordance with the pipe manufacturer's requirements and AWWA C-600. The pressure rating, metal thickness, net weight of pipe without lining, length of pipe, name of manufacturer and letters "DI" shall be clearly marked on each length of pipe.

1. Ductile Iron Fittings – Ductile iron fittings shall be mechanical joint except where noted otherwise on the Plans and/or Specifications and shall be installed using ductile iron restraining glands or rings. Approved glands for this purpose will be a restraining ring (wedge action) gland. Fittings shall be suitable for use at 350 psi (3–16 inch) and 250 psi (18-48 inch) of working pressure and shall conform to AWWA C110 or to AWWA C153. Fittings shall be cement mortar lined and the exterior coated with an approved bituminous coating, in accordance with AWWA C104. Compact ductile iron fittings meeting AWWA C153 may be furnished. Installation shall be in strict conformance with the pipe manufacturer's recommendations.

2. Restrained Push-On Joint Pipe and Fittings – Where required by the Plans and/or Specifications, restrained joint pipe and fittings shall be boltless restrained connection to protect against separation due to thrust. Positive restrained joint pipe and fittings may be used in lieu of friction restrained fittings. Positive restrained joint pipe and fittings shall be either mechanical joint or push-on joint and shall be manufacturer's standard restrained joint. The joint shall achieve restraint by means of a positive factory made, metal-to-metal contact and shall allow full deflection of the joint when made. Restrained push-on joints shall be on the Owners approved list of materials and manufacturers or approved equal and shall be installed in strict conformance with the pipe manufacturer's recommendations.

3. Friction Restrained Joint Pipe and Fittings – The following type friction restrained fittings may be used in lieu of positive restraint:

    a. Locked mechanical joint retainer glands of adequate strength to prevent movement may be used to supplement concrete backing. Locked mechanical joint retainer glands shall be ductile iron retainer glands equipped with either hardened cupped end set screws of a type which utilizes a multiple wedging action and twist-off nut to insure proper actuating of the restrained devices. If the retainer gland is installed and nuts twisted off, then the gland removed, then the gland shall not be reused. Refer to the Owner's approved list of materials and manufacturers and shall be installed in strict conformance with the pipe manufacturer's recommendations.

    b. Friction mechanical joint restraint may be used in lieu of locked mechanical joint retainer glands. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufacturer of ductile iron conforming to ASTM A536. Restraining devices shall be of ductile iron treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21 and ANSI/AWWA C153/A21, latest revision. Twist-off nuts shall be used to insure proper actuating of restraining devices. The mechanical joint restraint device shall have working pressure of at least 250 psi with a minimum safety factor of 2:1. Friction restraints shall be on the Owner's approved list of materials and manufacturers, or approved equal and shall be installed in strict conformance with the pipe manufacturer's recommendations.

c. A friction restrained joint gasket system utilizing stainless steel locking segments molded into the gasket may be used in lieu of mechanical joint retainer glands to achieve joint restraint for line sizes 4 inches through 24 inches. Gaskets shall be suitable for an allowable working pressure of 350 psi for 4" to 18" diameter pipe and 250 psi for 20" and 24" diameter pipe sizes. Proof-of-design tests have confirmed that the joints are capable of restraining dead-end thrust of two or more times the rated working pressure, as applicable. These tests shall be accomplished with the joints in both straight alignment and at the maximum rated deflection. The gasket rubber shall meet all material requirements of ANSI/AWWA C111/A21.11. The gasket shall be approved for use with plain ends in all sizes and shall be on the Owner's approved list of materials and manufacturers.

4. Flexible Joint Ductile Iron Pipe – Flexible Joint Pipe shall meet the requirements of AWWA C151 and may be of the bolted or boltless type suitable for 150 psi working pressure. If bolted type pipe is used, all bolts and nuts shall be Corten Steel. The interior shall be cement mortar lined as specified in AWWA C104. The exterior of all pipe and fittings shall receive an approved bituminous coating per AWWA C151, except the ball and machined surfaces which shall receive a protective coating as recommended by the manufacturer. All ball joint pipe shall be assembled, lubricated and installed in strict conformance with the pipe manufacturer's recommendations.

5. Polyethylene Sheath – Polyethylene sheath shall be installed on all ductile iron pipe, valves and appurtenances and fittings at all locations and shall conform to AWWA C105, latest revision, "Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids". The exterior of ductile iron pipe shall be covered with a sealed polyethylene sheath in accordance with AWWA C105 and shall be installed in strict conformance with the pipe manufacturer's recommendations.

6. Backfill shall be as specified elsewhere in these Specifications. Care shall be taken not to damage the polyethylene sheath during the backfill operation.

   a. Any polyethylene sheath which is damaged shall be replaced or repaired by adding a section of polyethylene sheath installed with adhesive tape, per AWWA C105, which is wrapped around the pipe and in accordance with AWWA C105. This shall be done by the Contractor at no additional expense to the Owner.

   b. The whole of the above standard shall apply with the following stipulation:

   c. Class A Polyethylene encasement shall not be exposed to sunlight longer than 7 days. In situations where the polyethylene encasement is expected to be exposed to sunlight longer than 7 days, Class C polyethylene shall be required.

   d. No polyethylene encasement shall be installed on pipe with bonded joints.

D. PVC Plastic Pipe for Water Lines:

1. 4 Inch through 12 Inch in Diameter (C900) – Polyvinyl chloride (PVC) plastic pipe in sizes from 4 inch through 12 inch shall conform to the requirements of AWWA C900, "Standard for Pressure Pipe with Cast Iron Pipe Outside Diameter". Pipe for potable water shall be blue and shall have a pressure rating of 235 with a Standard Dimension Ratio of 18 or heavier. Pipe joints shall be integral bell and spigot type with rubber ring sealing gasket. Lubricant for making joints shall be non-toxic NSF, and shall be as recommended by the pipe manufacturer. The pipe bell shall be designed to be at least as

strong as the pipe wall. Standard lengths shall be 20 feet except that 15 percent of total footage for a particular project may be random lengths of not less than 10 feet each. Each piece of pipe shall be tested by the manufacturer to 600 psi for a minimum of 5 seconds. The bell shall be tested with the pipe. Cast iron or ductile iron fittings conforming to the requirements of these Specifications shall be used with PVC pipe.

a. Contractor shall furnish written certification accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested, and inspected as required in AWWA C900. These certifications and test results shall be submitted, in five complete copies, to the Engineer for review and the pipe manufacturer shall retain duplicate copies of all test results in permanent files to be made available upon request. Refer to Testing Section of these Specifications.

b. The tests and certifications shall be of such frequency as to be representative of the entire project.

c. Marking on C900 pipe shall include the following, spaced at intervals of not more than 5 feet:

   i. Normal size and OD bore

   ii. PVC

   iii. Dimension Ratio

   iv. AWWA Pressure Class

   v. AWWA designation C900

   vi. Manufacturer's name or trademark and production code

   vii. National Sanitation Foundation (NSF) seal

2. Greater than 14" through 36" Diameter (C905) – Polyvinyl chloride (PVC) plastic pipe in sizes greater than 12" diameter shall conform to the requirements of AWWA C905, "Polyvinyl Chloride (PVC) Pressure Pipe 14" Through 36" for Water Transmission and Distribution Pipe for potable water shall be blue and shall be a minimum pressure rating of 235 with a Standard Dimension Ratio of 18 or heavier. Pipe joints shall be integral bell and spigot type with rubber ring sealing gasket. Lubricant for making joints shall be non-toxic NSF and shall be as recommended by the pipe manufacturer. The pipe bell shall be designed to be at least as strong as the pipe wall. Standard lengths shall be 20 feet except that 15 percent of total footage for a particular project may be random lengths of not less than 10 feet each. Each piece of pipe shall be tested by the manufacturer to 600 psi for a minimum of 5 seconds. The bell shall be tested with the pipe. Cast iron or ductile iron fittings conforming to the requirements of these Specifications shall be used with PVC pipe. Installation shall be in strict accordance with the manufacturer's recommendations.

   a. Contractor shall furnish written certification accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested, and inspected as required in AWWA C905. These certifications and test results shall be submitted, in five complete copies, to the Engineer for review and the pipe manufacturer shall retain

duplicate copies of all test results in permanent files to be made available upon request. Refer to Testing Section of these Specifications.

b. The tests and certifications shall be of such frequency as to be representative of the entire project.

c. Marking on C905 pipe shall include the following, spaced at intervals of not more than 5 feet:

i. Normal size and OD bore

ii. PVC

iii. Dimension Ratio

iv. AWWA Pressure Class

v. AWWA designation C905

vi. Manufacturer's name or trademark and production code

vii. National Sanitation Foundation (NSF) seal

3. PVC Plastic Pipe for Water Lines Under 4 Inch in Diameter (D2241) – Polyvinyl chloride (PVC) plastic pipe in sizes less than 4 inch shall meet the requirements of ASTM D2241. The PVC material used in the pipe shall have a cell classification of 12454-B as specified in ASTM D1784.

a. The pipe shall have a pressure rating of 200 psi at 73.4^{o}F, and a Standard Dimension Ratio (SDR) of 21.

b. The ends of the pipe and couplings shall be square to the centerline of the pipe barrel. Installation shall be in accordance with the manufacturer's recommendations.

4. General Requirement for PVC Pipe - Installation of PVC pipe shall be in accordance with these Specifications and as per requirement for AWWA C605. Field cutting shall be as defined by Uni-bell construction requirement. All types and classes of PVC pipe shall be on the Board's list of approved materials and manufacturers.

5. Marking for PVC Pipe

a. Tracer Wire: A 14-gauge, copper tracer wire with solid blue insulating jacket shall be buried 3 inches above the top of all PVC pipe. Backfill shall be carefully placed to a depth of 3 inches by hand to assure that the wire is secured in place over the pipe. It is the intent of this paragraph to provide means to locate PVC pipe using standard pipe location equipment. The wire shall be carried up through valve boxes and terminated at least 2 feet above the ground line to permit connecting of location equipment. Excess wire at valve boxes shall be neatly rolled and stored in the valve box.

b. Marking Tape for PVC Pipe: All PVC pipe shall be marked using a 6.0 mil tape buried at least 15 inches above the top of the pipe. Water mains shall be marked with blue tape labeled as "Caution Buried Water Line Below". Tape shall be 3 inches wide minimum and on the Board's list of materials and approved manufacturers.

After the tracer wire has been placed, the pipe trench shall be backfilled to approximately 15 inches over the top of the pipe then the nonmetallic tape shall be placed flat over top of pipe. Backfill shall be carefully placed to assure that the tape is secured over the pipe. The intent of the marking tape is to provide a visible marker in the event of excavation near a water line.

6. Fittings for PVC Pipe – Fittings for PVC pipe shall be ductile iron or cast-iron fittings as herein before specified for ductile iron pipe. PVC fittings may be used in 2-inch PVC water lines only and will not be paid for separately. PVC fittings shall be the standard design of the manufacturer supplying pipe and shall conform to the provisions of the Specifications governing the manufacture of PVC pipe. Special PVC to C.I. pipe adapters shall be provided for connecting PVC pipe to cast iron or ductile iron pipe or fittings, where required. Installation shall be in strict accordance with the manufacturer's recommendations.

7. Jointing of PVC Pipe - Jointing of PVC pipe shall be with rubber O-rings. Joints shall be made by means of an integral bell. Lubricant for making joints shall be non-toxic NSF approved, and shall be as recommended by the pipe manufacturer. Bells shall be manufactured so that O-ring gaskets are square to the barrel of the pipe. Cast iron or ductile iron fittings conforming to the requirements of these Specifications shall be used with PVC pipe. Fittings shall be mechanical joint and shall be provided with a transition gasket specifically designed to accommodate the outside diameter of the pipe. Installation shall be in strict accordance with the manufacturer's recommendations.

8. Restrained Joint Fittings - Where restrained joint fittings are required with PVC pipe, ductile iron pipe shall be used in lieu of PVC pipe and restrained joint fittings shall be as herein before specified for ductile iron pipe in Section 11.1.06.A, Materials, Ductile Iron Pipe. Installation shall be in strict accordance with the manufacturer's recommendations.

9. Mechanical Joint Restrained Devices – For C900 and C905 PVC Pipe, restraint devices for mechanical joint fittings and appurtenances shall conform to either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A2153. Restraint devices for nominal pipe sizes 4 inch through 36 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The gland body, wedges, and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.

    a. The mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

    b. Mechanical joint restraint shall be listed by Underwriters Laboratories in the 4 inch through 12 inch sizes and shall be Factory Mutual Approved. Mechanical joint restraints, 4 inch through 24 inch, shall meet or exceed the requirements of the latest revision of ASTM F1674. Mechanical joint restraints shall be on the Owner's list of approved materials and manufacturers, or approved equal and shall be installed in strict accordance with the manufacturer's recommendations.

E. Prestressed Concrete Cylinder Pipe (Through 48 inches):

1. General – Prestressed concrete cylinder pipe shall be of the lined or embedded cylinder type, and shall be designed, per the AWWA C304 standard, latest revision, and

manufactured in accordance with the AWWA C301 standard, latest revision, and installed in strict accordance with the manufacturer's recommendations. The pipe shall be furnished complete with gaskets, diapers and lubricant as required for proper installation and completion of the pipeline. Pipe shall be designed for a minimum working pressure of 150 psi, with a minimum surge allowance of 100 psi, and a minimum earth cover of 4 feet. The pipe shall also be designed for an AASHTO H-20 truck live load on unpaved road or flexible pavement and shall be in accordance with the AWWA C304, latest revision. The external loading shall be based on a soil density of 120 pounds per cubic foot and a bedding Type R3. The pipe shall be designed to withstand an internal vacuum pressure of -14.7 psi for all dead and live load application with no damage to the pipe lining. In addition, the pipe and restraint system shall be suitable for a field test to a pressure equal to the working pressure.

2. Welded Steel Cylinder shall be in accordance with AWWA C301 with a minimum thickness equal to that of 16 gauge steel plate and shall be installed in strict accordance with the manufacturer's recommendations.

3. Prestressing Wire shall be in accordance with AWWA C301, the minimum tensile strengths shall not exceed those in ASTM A648, Class III, and the prestressing wire diameter shall be 6 gauge minimum, as per AWWA C301 and ASTM A648. The wire shall be tested in accordance with ASTM A648 and A370 (and supplement IV) specifications with the following modifications or stipulations. Tests shall be conducted on one specimen for every coil of wires for tension, bend, reduction of area and wrapping tests. The reduction of area test shall meet the requirement of 35 percent minimum.

4. Concrete Cores and Mortar Coating shall be in accordance with AWWA C301, except that the thickness shall provide a minimum cover of 1-inch over the wire.

    a. A minimum of 6.5 sacks of cement shall be used per cubic yard of concrete. Water cement ratio shall not exceed 0.44. Submit concrete mix designs to the Owner. Mortar for coating shall consist of at least 1 part cement to not more than 3 parts fine aggregate. No mixture shall be used without prior review and approval of Engineer.

    b. Concrete test cylinders, at the time of wrapping, shall attain a minimum compressive strength of 3,000 psi for vertically-cast cores and 4,000 psi for core concrete placed by centrifugal casting or radial compaction. When the core concrete is to be placed by centrifugal casting and the companion cylinders are formed via rodding, then the core concrete shall be considered to be one-third stronger than the rodded test cylinders. The minimum 28-day strength of the core concrete shall be 4,500 psi for vertically-cast cores and 6,000 psi for cores placed via centrifugal casting or radial compaction. The initial compressive stress induced in the concrete core shall not exceed 55 percent of the compressive strength of the concrete at the time of wrapping.

    c. The neat cement slurry shall be applied using a suitable nozzle. The manufacturer shall insure that the slurry application method is adequate to provide complete coating of the prestressing wires.

5. Joint Rings shall be zinc metallized to a minimum 0.004 inches thick.

6. Marking – Each length of pipe and each fitting shall be plainly marked to show:

    a. Name of manufacturer.

b. Pressure rating.

c. Depth of allowable cover.

d. Proper location of pipe or fitting in the pipeline by reference to layout drawings and schedules furnished by manufacturer.

e. Beveled pipe and elbows shall be marked to indicate the point of maximum length.

f. Each fitting or special shall be sufficiently marked to indicate its position in the pipeline.

g. Pipe with steel cylinders thicker than standard shall be marked.

7. Testing of the cylinder assembly, concrete, special specimens and rubber for gaskets shall be conducted in accordance with AWWA C301. Test reports shall be submitted to Owner. The expense of testing, and of submitting test reports shall be borne by the manufacturer.

8. Restrained Joints for prestressed concrete cylinder pipe shall be of the type which provide uniform bearing around the entire circumference of the joint. Joints which provide restraint by concentrated point loads which permanently deform portions of the joint metal will not be accepted. Joints shall be on the Board's list of materials and approved manufacturers and shall be installed in strict accordance with the manufacturer's recommendations

9. Flange Joints – Concrete pipe flange joints shall be compatible with the flange joints specified for ductile iron pipe and valves. The concrete pipe flanges shall have the same outside dimensions as the ductile iron pipe and/or valve flanges. Steel flanges shall be AWWA C207 Class D, 150 psi, flat-faced, drilled compatible with ductile iron pipe and/or valves and shall be installed in strict accordance with the manufacturer's recommendations.

10. Fittings, Flanged Pipes and Special Pipes shall be designed for the same design pressure condition as the pipe and in accordance with AWWA C301 and the AWWA M9 Manual for Concrete Pressure Pipe and shall have a minimum safety factor of 2 at design pressure 150 psi plus 100 psi surge, based on minimum steel plate yield strength, and shall have a minimum steel cylinder thickness of 3/8 inches. Installation shall be in strict accordance with the manufacturer's recommendations.

    a. Interior lining and exterior coating of fittings shall be wire fabric, reinforced mortar and have a minimum thickness of ¾ inches and 1-inch, respectively. The inside diameter of the fittings shall be smooth and the same as the pipe. All exposed steel surfaces not lined or coated with mortar shall be coated with NSF approved paint in accordance with AWWA C210. Any areas abraded in handling shall be touched up in the field.

    b. The interior and exterior surfaces of outlets and connections shall be lined and coated with reinforced mortar for sizes larger than 12 inches. For sizes 12 inches to 8 inches the thickness of reinforced mortar lining shall be a minimum of 3/8 inches on all outlets and connections smaller than 6 inches shall be coated in accordance with AWWA C210.

11. Pipe for Installation in Tunnel Casings shall be designed to withstand the jacking force, and the pipe manufacturer shall be required to advise the Contractor of the proper procedure of jacking so as not to damage the pipe. Any direct contact of pipe coating with the casing pipe shall not be permitted. Raised mortar coating skids can be used to provide protection to the mortar coating where it contacts the invert of the steel tunnel casing.

12. Installation shall be in strict accordance with the manufacturer's recommendations and AWWA Manual M9, "Concrete Pressure Pipe".

F. Gate Valves:

1. Metal Seated Gate Valves – All valves shall be non-rising stem for underground direct burial service and shall close when the operating nut is turned in clockwise rotation. Valves shall be in accordance with and meet the requirements and recommendations of AWWA C500. O-ring seals shall be provided. Seats shall be parallel with double disc. Valves shall be furnished complete with necessary gaskets, bolts, nuts as needed for mechanical joint end. Gaskets shall be suitable for potable water service. Gasketed joints shall comply with the latest published AWWA C111 for Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings and shall be installed in strict accordance with the manufacturer's recommendations.

    a. Valves (16 inches and Smaller): Each valve shall have mechanical joint ends, and shall be on the Board's list of materials and approved manufacturers. Valve shall be installed with the operating stem in the vertical position. Valve stem shall be furnished with 2-inch square water works nut.

    b. Valves (18 Inches and Larger): Each valve shall have mechanical joint ends and shall be on the Board's list of materials and approved manufacturers. Unless otherwise specified, valves shall be horizontal mounting and shall be provided with by-pass valve with 2 inch square operating nut. The main valve shall be provided with watertight bevel gear case with outside packed stuffing box with a gland enclosure. Both main valve stem and pinion stem shall be provided with accessible alemite connections. The test plug in each main valve shall be provided with a brass gage cock with handle.

2. Resilient Seated Gate Valves – All valves shall be non-rising stem for underground direct burial service and shall close when the operating nut is turned in clockwise rotation. Valves shall be in accordance with and meet the requirements and recommendations of AWWA C509. O-ring seals shall be provided. The valve shall be a compression resilient seated gate valve. Disc shall be styrene butadine rubber coated. Valve body shall be fusion-epoxy bonded inside and out. Valves shall be furnished complete with necessary gaskets, bolts, nuts as needed for mechanical joint ends. Gaskets shall be suitable for potable water service. Gasketed joints shall comply with the latest published AWWA C111 for Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings and shall be installed in strict accordance with the manufacturer's recommendations.

    a. Valves (12 Inches and Smaller): Each valve shall have mechanical joint ends and shall be on the Board's list of materials and approved manufacturers. Valve shall be installed with the operating stem in the vertical position. Valve stem shall be furnished with 2-inch square water works nut.

3. Ductile Iron Resilient Seated Gate Valves: Valves that meet or exceed all of the requirements and recommendations of AWWA C515, may be used provided they meet the additional criteria listed in this section. Valves shall be on the Board's list of materials and approved manufacturers and shall be installed in strict accordance with the manufacturer's recommendations.

    a. Polyethylene encasement shall be installed on all ductile iron valves at locations where buried and shall conform to AWWA C105, latest revision, "Standard for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids".

    b. The whole of the above standard shall apply with the following stipulation:

    c. Class A polyethylene encasement shall not be exposed to sunlight longer than 7 days. In situations where the polyethylene encasement is expected to be exposed to sunlight longer than 7 days, Class C polyethylene shall be required.

G. Butterfly Valves:

1. General – Butterfly valves shall be rubber seated for 150 psi minimum working pressure and line velocities up to 16 fps. The bodies of all valves shall be cast iron construction of ASTM A126, Class B, or ASTM A48, class 40. Valves shall be on the Board's list of materials and approved manufacturers. Underground valves shall be provided with operators with non-corrosion type construction for input shaft, seals, bushings and bolting. Operators shall be totally enclosed and permanently lubricated for direct burial of the valves and frequent submergence in water up to 20 feet of head. The operators shall open the valves on a counterclockwise rotation of the operator wrench nut which shall be AWWA 2 inch square cast iron. The valve ends shall be mechanical joint in accordance with AWWA C111, except where indicated otherwise on the Proposal, and shall be installed in strict accordance with the manufacturer's recommendations.

    a. Except as modified herein, the butterfly valves and operators shall meet, or exceed, the applicable requirements of the Specifications for Rubber Seated Butterfly Valves, AWWA C504, for Class 150B.

2. Stuffing Boxes – All butterfly valves shall be provided with O-ring seals, nonadjustable stuffing boxes, and shall be self-sealing or self-adjusting type, which can be replaced without the necessity of removing the valve or the valve shaft from its pipeline location. Installation shall be in strict accordance with the manufacturer's recommendation.

3. Valve Shafts – The valves shall be installed with the valve shaft in a horizontal position. The shaft shall be of 18-8 stainless steel, Type 304. Shafts shall be a one piece design on sizes up to 12", sizes 14" and larger shall be of a two piece design that allows for a flow through vane design. Valve disc shall be keyed or pinned securely to the valve shaft, with valve shaft completely sealed from the pipeline contents. Pins, wedges and accessories shall be 18-8 stainless steel, Type 304 or 316. Valve shafts must meet or exceed the minimum connection torque as specified in AWWA C504 and shall be installed in strict accordance with the manufacturer's recommendations.

4. Valve Discs – The material for valve discs may be ductile iron ASTM A536 or ASTM A48 Class 40 cast iron.

5. Valve Seats – The mating seat surfaces shall be 18-8 stainless steel on natural rubber.

H. Tapping Valves and Sleeves: Tapping valves shall meet the requirements set forth for gate valves as directed on these Specifications, shall be on the Board's list of materials and approved manufacturers and shall be installed in strict accordance with the manufacturer's recommendations. Tapping sleeves shall meet applicable requirements of these Specifications as set forth for ductile iron or cast iron pipe. All tapping sleeves shall be full stainless steel sleeve. Tapping sleeves being 12 inch and smaller shall have a minimum working pressure of 200 psi and larger sleeves shall have a minimum working pressure of 150 psi. Tapping sleeves shall be full stainless steel sleeve and shall be in accordance with AWWA Specification C104. The interior surface of the tapping sleeve and the exterior of the pipe shall be disinfected as approved by the Inspector. Tapping valves and sleeves are to be used for making connections to existing mains. Size on size taps are only allowed with the use of a stainless steel tapping sleeve. Resilient seated tapping valves require testing with the valve closed and no allowable leakage. For metal seated tapping valves, the procedure for testing is described in the section designated for testing in these specifications.

I. Fire Hydrants:

1. All fire hydrants shall meet or exceed AWWA C-502, latest revision and shall be of the traffic-model design, rated at 200 psi working pressure and 400 psi hydrostatic pressure. The hydrant valve shall be a minimum of 5-1/4" and a compression type that closes with the pressure. All operating parts, including the drain ring, operating nut, hold-down nut, upper valve plate, seat ring, drain lever, and nozzles shall be made of bronze. Installation of fire hydrants shall be in strict accordance with the manufacturer's recommendations.

2. The bonnet assembly shall provide for an oil or grease reservoir and lubricating system that lubricates all stem threads and bearing surfaces each time the hydrant is operated. The reservoir shall be completely sealed from the waterway and all external contaminants by two O-ring stem seals. Hydrants shall be factory prefilled with a lubricant suitable for a working range of -60 degrees F. to +150 degrees F. and shall comply with USDA Safety and Health Regulations. Material Safety Data Sheets shall be made available if requested.

3. Hydrants shall be provided with two 2-1/2" bronze hose nozzles and one 4-1/2" bronze pumper nozzle. All nozzle threads shall be National Standard Fire Hose Coupling thread. Nozzle caps shall be cast iron or ductile iron and provided with gaskets and chains.

4. Hydrants shall have a 6" mechanical joint inlet, less accessories, with the interior of the hydrant shoe fully fusion bonded epoxy coated to a thickness of at least 4 mils in accordance to AWWA C-550 and the exterior of the hydrant shoe coated with at least 8 mils of asphaltic coating or epoxy coated to the same specifications as the interior.

5. The exterior of the lower barrel shall be coated with 4 to 8 mils of asphaltic coating in compliance with ANSI/AWWA C110/A21.10. The interior of the lower barrel shall be seal coated in accordance with the requirements of Seal Coating in ANSI/AWWA C104/A21.4 to a thickness of no less than 4 mils.

6. Flanges of the hydrant lower barrel shall be integral cast with the barrel, screwed on, or of a connection type approved by the Owner.

7. The shoe of the hydrant shall be made of ductile iron. If the shoe is made of ductile iron, the lower barrel shall be made of ductile iron. Shoes and lower barrels made of ductile iron shall have the letters "DI" or "Ductile" stamped or stenciled (painted) on them.

8. Hydrants shall utilize three-quarter inch (3/4") bolts meeting ASTM A-307 Grade B, zinc coated by the hot dip process, in accordance of Class C of Specifications A-153, to secure the lower barrel to the hydrant shoe or type 316 Stainless Steel bolts shall be used if the bolts are less than ¾" in diameter.

9. Hydrants shall be of the three-way design with the upper barrel capable of full 360 degree rotation by any degree. The orientation of 4 ½" pumper nozzle shall face the street or at an expected location of a fire truck. Nozzle shall be no less than 18 inches nor more than 24 inches from final ground elevation. Safety flange shall be approximately 2-3 inches above finished ground level to provide access to bolts and nuts.

10. Hydrants shall have a 1-1/2" pentagon, one-piece operating nut and open left. Protection from weather shall be accomplished by one or both of the following methods:

    a. A weather cap made of cast iron and firmly attached to the operating nut by means of a screw passing through the center of the weather cap and into the top of the operating nut. The base of the weather cap shall be larger in diameter than the diameter of the hold-down nut. The weather cap shall be of a type that can be easily removed for maintenance and will provide tamper resistance. The bronze hold-down nut will have a weather seal preventing water entry.

    b. An exterior rubber seal to prevent water entry and a redundant interior rubber seal for additional protection. (2 separate seals).

11. Hydrants shall allow for the easy installation of barrels or extensions at the hydrant shoe or groundline without having to shut off the water main.

12. Hydrant extensions, where required, shall be installed by the Contractor and considered an incidental to fire hydrant installation. Where hydrant risers are required, the Contractor shall inform himself of the type of hydrant riser to be used and its proper installation, taking special precaution to ensure that the break-away flange of the riser is installed next to the hydrant barrel and not below grade. Design, materials, and workmanship shall be similar and equal to the latest stock pattern produced by the manufacturer and that hydrant shall be of the same general type as the hydrants in the existing system.

13. Hydrants shall be furnished by the manufacturer with bury line indicated on manufactured barrel. Hydrants shall not be buried below the manufacturer's bury line nor shall bury line exceed 3-inches above finished grade. Height of the flange shall be above the finished grade.

14. Additionally, all hydrants shall have caps on each nozzle, with chains tied together and secured to the hydrant barrel to prevent loss of caps. All caps and threads shall be cleaned and greased by the Contractor to allow for ease of removal in the future.

15. The inside diameter of hydrant barrel shall be 6.125 inches or greater. Hydrants with barrels less than 7 inches shall meet AWWA C-502 minimum wall thickness requirements for a 7 inch inside diameter barrel.

16. Friction losses through the hydrant shall not exceed 7.6 psi at 1500 gpm or 3.0 psi at 1000 gpm through the pumper nozzle, and 1.25 psi at 500 gpm through two (2) hose nozzles when tested simultaneously as outlined by AWWA C-502. Flow test results indicating the friction losses through the hydrant shall not be older than 12 months from

the date said results are requested by MAWSS. Flow tests must be conducted by an independent lab. Each manufacturer must provide written certification, if requested, that their hydrants meet all of the Board's hydrant specifications.

17. Hydrants shall be painted in accordance with the requirements of AWWA C-502. The outside of the hydrant top section shall receive one coat of shop-applied primer (Federal Specifications TT-P-86-Type IV, TT-P-636, or equal). After hydrant is installed, it shall be cleaned and prime applied to scraped or abraded areas. Hydrants shall receive an immediate coat and final coat of paint meeting Federal Specifications TT-E-489 applied at a dry thickness of 2 mils per coat. Paint shall be Kem Kromic Universal Metal Primer B50WZ1, Steel Master 9500 30% Silicone Alkyd.

    a. Hydrant barrel color shall be Safety Yellow (SW4084).

    b. Hydrant top (bonnet) color shall conform to the following table according to flow test results:

HYDRANT CLASS	**BONNET COLOR**	**RATED CAPACITY AT 20 PSI RESIDUAL PRESSURE**
AA	Safety Blue (SW4086)	1500 GPM or Greater (5680 L/min)
A	Safety Green (SW4085)	1000-1499 GPM (3784-5675 LO/min)
B	Safety Orange (SW4083)	500-999 GPM (1900-3780 L/min)
C	Safety Red (SW4081)	< 500 GPM (1900 L/min)

    c. Flow tests will be conducted by the Board's personnel. Requests for flow testing shall be presented to MAWSS Project Manager or Construction Inspection Department for Developments.

18. Complete drawing standards and certificate of compliance must be furnished when requested. Should any accepted fire hydrant change design or material of present accepted fire hydrant, the Board of Water and Sewer Commissioners of the City of Mobile must be notified in writing prior to the change and the fire hydrant must be resubmitted for approval.

19. All hydrants shall have a 10-year warranty, a copy of which is to be made available on demand, identified from the cast date on the upper barrel of the hydrant.

20. Hydrants shall be shipped on a trailer or truck that will allow the unloading of the hydrants from both sides of the trailer or truck with a forklift. Any hydrants delivered in an enclosed trailer or truck that does not allow access to the hydrants from both sides with a forklift will be immediately rejected and not unloaded.

21. Hydrants will be visually inspected for compliance with these specifications upon arrival at the Board Warehouse. Hydrants that clearly do not meet these specifications upon delivery, will not be accepted and will be returned to the shipper on the same truck that delivered them.

22. If it is discovered that hydrants accepted by the Board Warehouse do not meet these specifications, the provider of said hydrants will be asked to replace the noncompliant hydrants. No new hydrants will be ordered until the noncompliant hydrants are replaced.

J. Air Release Valves: Air release valves shall be located as shown on the Plans and shall be on the Board's list of materials and approved manufacturers. Flanged fittings shall comply with AWWA C110 and have ANSI B16.1 Class 125 flanges.

K. Valve Boxes: Cast iron valve boxes shall be provided for all valves installed vertically and shall consist of a base covering the operating nut and head of the valve, a vertical shaft of at least 5-1/4 inches in diameter, and a top section extending to a point even with the finished ground surface, provided with a cast iron cover marked "Water" and placed concentrically over the operating nut. Valve boxes shall be on the Board's list of materials and approved manufacturers.

L. Valve Stem Extensions: All valves in which the operating nut is greater than 3 feet below the normal ground or road surface shall be provided with extension stems to bring the operating nut to within 3 feet of the finished grade. The extension stem shall be provided with a 3 inch square operating nut on top and a coupling to connect the extension to the operating nut of the valve. A stem guide shall be provided to keep the valve stem extensions concentric with the valve box. Extension stems shall be of the same diameter as the valve stem unless otherwise specified and shall be on the Board's list of materials and approved manufacturers.

M. Anchoring Fittings: Ductile iron and cast iron anchoring fittings shall meet the requirements for ductile iron or cast iron fittings, and shall be "Plain End" mechanical joint fittings with integral follower gland.

N. Rustproof Rods for Anchorage: The threaded rods for anchorage shall be galvanized or stainless steel conforming to ASTM A36, as required by the Owner or Engineer. The rods shall be clean of all rust and foreign matter.

O. Formed Concrete: The minimum compressive strength required at 28 days is 3,000 pounds per square inch. Field specimens and laboratory tests shall be made in accordance with the standards of the American Society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed 6 U.S. gallons per sack of cement.

P. Crushed Slag or Crushed Stone: See Section 16 entitled "Erosion Control", Paragraph entitled "Crushed Slag or Crushed Stone". Refer to the standard detail drawings for pipe embedment.

Q. Corporation Stops: Corporation stops where required or directed, shall have standard CC Corporation Stop Thread on inlet as specified by AWWA C800, shall be self-restraining and copper tubing size O.D. outlet suitable for service piping. All components shall be rated for 300 psi. Corporation stops may be tapped directly into ductile iron mains 6" and larger. Corporation stops shall be tapped into ductile iron mains smaller than 6" and other water mains only by means of a bronze service clamp. Corporation stops shall be on the Owner's list of approved materials and manufacturers.

R. Curb Stops: Curb stops where required or directed, shall be suitable for service piping and shall be rated for 300 psi. Curb stops shall be on the Owner's list of approved materials and manufacturers.

S. Pipe for Service Connections: Water service piping shall meet the following requirements:

1. Copper service pipe shall be seamless copper water tube, ASTM B88, Type K. All service lines shall be continuous with compression type connections specified in AWWA C800; no splices will be allowed. A typical household installation will require 1" diameter pipe. Service lines shall have a minimum cover of 24 inches. All trenching for taps shall be left open until successful completion of pressure test unless otherwise approved, but in no case shall taps be backfilled until visually inspected by MAWSS representative.

T. SERVICE TAPPING SADDLES: Tapping saddles shall be installed only after the main line has been pressurized (hot tapped) and pressure is to be maintained. No taps shall be made on main lines while are they are empty or non-pressurized. Service tapping saddles shall be specific for the material being tapped and designed to prevent deformation of pipe. The rubber gasket shall be confined and provide a full life seal against leakage. Saddles shall be heavy duty double strapped or single "full" width strap with double connection points on strap and shall be fusion epoxy coated. Service tapping saddle is included in a water service tap assembly and shall be selected from the Utility's approved manufacturer and acceptable products list.

U. METERS: Meter installation shall be coordinated with and supplied and installed by MAWSS forces.

V. METER BOXES: Meter boxes shall be 12" standard polyplastic meter box with polyplastic lid. Meter box size shall be dependent upon meter size and shall be sufficient to house the meter, curb stop and transmitter. Meter boxes for meters < 3-inches shall be rated for non-traffic or pedestrian areas and shall be selected from the Utility's approved manufacturer and acceptable products list. Meter boxes for traffic areas and meters 3" and larger shall be determined by MAWSS.

W. Pressure Regulating/Sustaining Valves: Shall be CLA-VAL 90G-20BSYKCG, or equal. Pressure settings shall be as approved by the Board. Valve shall include open/close limit switch. Provide reinforced concrete vault with removable top section and cast iron access cover. Valve setting shall include sleeve to facilitate valve removal, 3/8" NPT taps (plugged) each side of pressure regulatory/sustaining valve and isolation valves.

X. Fire Hydrant Location Markers: At each fire hydrant location, blue reflectors shall be installed in the street to mark the location of the fire hydrant. The reflectors shall be Stimpsonite 2-Way Blue or an approved equal. One reflector shall be installed in the middle of the traffic lane closest to the hydrant. The reflector shall be located at a position where a line passing through it and the fire hydrant will be perpendicular to the centerline of the road. If the fire hydrant is located at an intersection, a reflector shall be placed in each of the two streets forming the intersection.

11.1.07 INSPECTION

A. Of Material at Factory: All materials are subject to inspection and approval at the plant of the manufacturer.

B. All material shall meet the requirements specified and suppliers of pipe and fittings shall furnish, five copies, to the Owner, and an affidavit stating that all pipe and fittings furnished under this Contract conforms to the requirements as set forth in these Specifications. The

manufacturer's drawings of any special materials required for the job shall be submitted to the Engineer for review prior to installation.

C. Of Materials at Delivery Point: During the process of unloading, all pipe and accessories shall be inspected by the Contractor for loss or damage in transit.

D. Field Inspections: All pipe and accessories shall be laid, jointed, tested for defects and for leakage with pressure in the manner herein specified and in the presence of the Engineer or his authorized representative.

E. Test Reporting: Prior to completion of the work, the Contractor shall furnish written certification, accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested, and inspected as required. These certifications and test results shall be submitted, in five complete copies, to the Engineer for review and the pipe manufacturer shall retain duplicate copies of all test results in permanent files to be made available upon request.

F. Disposition of Defective Material: All material found during the progress of the Work to have flaws or other defects will be rejected and the Contractor shall promptly remove from the site of the Work such defective material.

11.1.08 HANDLING PIPE AND ACCESSORIES:

A. Care: Pipe, fittings, valves, hydrants, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the Project by the Contractor. Materials shall at all times be handled with care to avoid damage. In loading and unloading, all pipe and fittings shall be lifted so as to avoid shock or damage. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground. Under no circumstances shall such materials be dumped, dropped or otherwise handled in a manner which may cause damage. Material handling shall be in strict accordance with the manufacturer's requirements.

B. At Site of Work: In distributing the material at the site of the Work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

C. Care of Pipe Coating: All pipe, valves, fittings and appurtenances shall be handled so as to prevent any damage whatsoever, particularly to the lining or coating. Under no circumstances shall bare forks be placed inside of pipe or fittings while unloading or moving. Damaged coating shall be repaired in accordance with the pipe manufacturer's recommendations.

D. Bell Ends, How Faced: Pipe shall be placed on the site of the Work parallel with the trench alignment and with bell ends facing the direction in which the Work will proceed.

E. Pipe Kept Clean: The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Each pipe shall have a swab run through it until all foreign matter has been removed. The spigot ends and gasket seating area of all pipe and fittings shall be thoroughly cleaned of any sand or debris prior to assembly. The Owner has the right to reject any pipe that has not been stored in a clean condition.

F. Frost Protection: Valves and hydrants before installation shall be drained and stored in a manner that will protect them from damage by freezing. Any valves or pipe damaged by freezing during the work shall be replaced at the Contractor's expense.

11.1.09 REMOVING AND REPLACING PAVEMENT:

A. See Section 14 entitled “Removing and Replacing Pavement”.

11.1.10 ALIGNMENT AND GRADE:

A. General: All pipe shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations, with joints centered and spigots home, and with all valve and hydrant stems plumb.

B. Beginning of Work: No water mains shall be installed until the Inspector has determined that adequate staking and project controls are in place to insure precise location of mains and appurtenances. Mains shall be constructed in the center of easements unless approved otherwise by the Engineer.

C. Protecting Underground and Surface Structures: Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished by the Contractor at his own expense.

D. Deviation with Owner’s/Engineer’s Consent: No deviation shall be made from the required line or grade except with the written consent of the Owner and/or Engineer.

E. Subsurface Explorations: Whenever necessary to determine the location of existing pipes, valves, or other underground structures, the Contractor shall examine all available records and shall make all explorations and excavations for such purpose. This investigation shall be made in advance of any pipe laying.

1. Depth of Pipe Cover: All pipe shall be laid to the depth shown or described, measured from the proposed or established street grade or the surface of the permanent improvement to the top of the barrels of the pipe.

2. Pipes 16 inches and larger shall have minimum cover of 48 inches, and pipes smaller than 16 inches shall have minimum cover of 30 inches, except where otherwise noted on the Plans. At street intersections or where the new pipelines cross existing or proposed underground lines at the approximate same depth as the new line, the cover shall be increased and the new line laid below the existing or proposed pipelines. Where the new pipeline crosses existing or proposed ditches, the top of the pipe shall be a minimum of 36 inches below the existing or proposed invert of ditch, whichever is lower, except where noted on the Plans.

3. Minimum cover over all service lines shall be 24 inches. Should this requirement be ignored, the Contractor shall be required to uncover taps for inspection prior to beginning of pressure test. All service lines, regardless of size, which are installed under storm drains shall be encased in plastic or steel casing for a minimum length of 5 feet beyond the storm drain on either side.

F. Pipe Clearance Distances: Required clearance between water and sewer mains shall be a minimum of 18 inches vertical distance (with water line crossing over sewer line), pipe joints not within 5 feet of sewer main on either side of crossing, and 10 feet horizontal distance. At locations where these clearance conditions cannot be satisfied, encasement pipe, as directed by the Engineer, shall be required. If practical, no joints should be allowed within 6 feet of sewer mains or storm drains on either side of crossings.

11.1.11 EXCAVATION AND PREPARATION OF TRENCH:

A. Description: The trench shall be dug to the alignment and depth required and only a minimum distance in advance of pipe laying. The trench shall be so drained that workmen may work therein efficiently. It is essential that the discharge of water being pumped from the trench conform to the BMP program, or the Contractor's erosion control plan, and in accordance with City, County, ALDOT or ADEM requirements.

1. The Contractor may be required to utilize settling tanks to remove sediment from the discharge water of the dewatering pump prior to discharging into any jurisdictional drainage way or MAWSS facility.

2. Unless the Contractor can provide test results showing zero fecal coli forms, they shall discharge the water into the nearest existing downstream sanitary sewer manhole at a controlled rate such that the capacity of the existing sewer pipe is not exceeded.

3. The above discharge requirements can be amended, if the Contractor obtains written permission from the appropriate governmental agency to allow for discharge into their drainage system.

4. The Contractor shall provide a discharge plan which addresses the above requirements to the Engineer or Owner for approval prior to implementation.

B. Width: The trench width may vary with and depend upon the depth of trench and the nature of the excavated material encountered, but in any case shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of unsheeted trench shall be 18 inches. For pipe 8 inches in diameter or larger, the minimum clear width of the trench, sheeted or unsheeted, at the top of the pipe, shall be the pipe outside diameter plus 12 inches. The maximum clear trench width, sheeted or unsheeted, at the top of the pipe, shall be the outside diameter plus 24 inches.

C. Pipe Foundation in Good Soil: The trench, unless otherwise specified, shall have a flat bottom, conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil cut true and even so that the barrel of the pipe will have a bearing for its full length.

D. Correcting Faulty Grade: Any part of the trench excavated below grade shall be corrected with approved material, thoroughly compacted.

E. Pipe Foundation in Poor Soil: See Section 15 entitled "Backfilling".

F. Bracing: Bracing (trench restraint) shall be as specified in Section 7 entitled "Legal Relations and Responsibility to Public", Paragraph entitled "Bracing".

G. Care of Surface Material for Re-Use: If local conditions permit their re-use, all surface material suitable for re-use in restoring the surface shall be kept separate from the general excavation material.

H. Manner for the Placement of Excavated Material: All excavated material shall be piled in a manner that will not endanger the Work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clean or other satisfactory provisions made for street damage. Also storm drains shall be kept clear.

I. Bell Holes Required: Bell holes of ample dimensions shall be dug in earth trenches at each joint to permit the jointing to be made properly. Where the natural soil at the bottom of the trench makes a satisfactory foundation for the pipe, it shall be shaped to the bottom quadrant of the pipe and slightly hollowed under each bell to allow the body of the pipe to have uniform contact and support throughout its entire length. The bell shall not support the pipe.

J. Trenching by Machine or By Hand: The use of trench-digging machinery will be permitted, except in places where operations of same will cause damage to trees, buildings, or existing structures above or below ground, in which case hand methods shall be employed.

K. Barricades, Guards, and Safety Provisions: To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning devices, and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the trenched highway. Rules and regulations of the local authorities respecting safety provisions shall be observed.

L. Traffic and Utility Controls: Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic (both vehicle and/or pedestrian) must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire or Government communication call boxes, or other utility controls shall be left unobstructed and accessible during the construction period. Traffic control implemented during construction shall comply with the MUTCD, ALDOT, County, City requirements for traffic control.

M. Flow of Sewers and Drains Maintained: Adequate provisions shall be made for the flow of sewers, drains and water courses encountered during construction, and the structures which may have been disturbed shall be satisfactorily restored upon completion of the Work. The Contractor shall maintain proper drainage at all times. The Contractor shall be responsible for managing storm water runoff from the work site.

N. Property Protection: Trees, fences, poles and all other property shall be protected unless their removal or modification is authorized; and any property damaged shall be satisfactorily restored by the Contractor.

O. N. Interruption of Water Service: No valve or other control on the existing system shall be operated for any purpose by the Contractor without approval of the Owner, and all consumers affected by such operation shall be notified by the Contractor at least 48 hours before the operation and advised of the probable time when the service will be restored. Depending upon the length of the discontinued service to the consumers, the minimum required time of the notification may be extended.

11.1.12 PIPE LAYING

A. Manner of Handling Pipe and Accessories into Trench: Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the Work. All pipe, fittings, valve, and accessories shall be carefully lowered into the trench, piece by piece, by means of derrick, ropes or other suitable tools or equipment, in such manner as to prevent damage to pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

1. Protection of Pipe: All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and the pipe inside shall be kept clean

by the use of a cap or pipe plug during and after laying. Contractor shall exercise care in keeping all foreign materials out of main before and during installation. Should this requirement not be adhered to, pipe shall be removed, cleaned and replaced, or pipe shall be cleaned by running a series of polyfoam pigs through the pipeline, at the Contractor's expense.

B. Laying Pipe: After placing a length of pipe in the trench, the joint shall be held around the bottom of the spigot so that it will enter the bell as the pipe is shoved into position. Joint material shall meet regulations of agency having jurisdiction.

1. The spigot shall be centered in the bell, the pipe shoved into position, and brought into true alignment; it shall be secured there with earth carefully tamped under and on each side of it, except at the bell holes. Care shall be taken to prevent dirt from entering the joint space. Each joint shall be inspected for rolled gaskets where applicable. Joints with rolled gaskets will not be accepted and must be removed and replaced.

C. Preventing Trench Water from Entering Pipe: Whenever pipe laying is stopped for the night or for any other cause, the end of the pipe shall be securely closed with a stopper to prevent the entrance of water, mud, or other obstructing matter, and shall be secured in such manner as to prevent the end pipe from being dislodged by sliding or other movement of the backing.

D. Cutting Pipe: Cutting the pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. All field cutting of pipe shall be done in strict accordance with the pipe manufacturer's recommendations.

E. Bell Ends to Face Direction of Laying: Pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall face upgrade.

F. Permissible Deflection at Joint: Pipelines intended and/or shown to be laid in a straight line shall be laid straight with no deflection at the joints. No deflection will be allowed unless necessary due to grade, curves or to avoid obstructions. Wherever necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions, to plumb stems, or where long radius curves are permitted, the degree of deflection shall be in accordance with the pipe manufacturer's recommendations.

G. Railroad and Highway Crossing: When any railroad or highway is crossed, all precautionary construction measures required by the railroad and highway officials shall be followed.

H. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water, or when the trench conditions or weather is unsuitable for such work. The Contractor shall remove any water which may be found or may accumulate in the trenches and shall perform all work necessary to keep them clear of water while any structures are being placed or pipe laying is in progress. Such water removal shall be accomplished by means of a well point system or other approved means. Comprehensive plans for dewatering operation, if used, shall be submitted prior to installation. No extra payment will be made for dewatering.

11.1.13 JOINTING PIPE:

A. Mechanical, push-on, or other type joints shall be installed and lubricated in strict accordance with the recommendations of the pipe manufacturer. Each installed joint shall be flashed to check for protruding or rolled gaskets. Protruding or rolled gaskets shall be removed and replaced in accordance with the manufacturer's recommendations.

11.1.14 SETTING VALVES, VALVES BOXES, FITTINGS AND BLOW-OFFS:

A. General: Gate valves and pipe fittings shall be set and jointed to a new pipe in the manner specified for cleaning, laying and jointing pipe, and shall be plumb. Valves shall be installed so that stems are vertical and easily accessible from the surface and joints shall be assembled as per specifications for mechanical joint fittings. Where two, three, or four way valving is called for at intersections, valves should be installed at equal distances from tees and crosses.

B. Valve Boxes: Valve boxes shall be set vertical and concentric with the valve stem. Valve boxes shall be firmly supported and maintained, and the box cover shall be flush with the surface of the finished ground elevation or at such other level as may be directed. Backfill and compact the area around the valve body with gravel or other suitable and approved granular material before setting the valve box so that the valve box does not rest directly on the valve body or pipeline. Backfill around valve boxes shall be the same as that specified for the adjacent pipe and shall be carefully and thoroughly compacted. Care should be taken to ensure that valve box is not displaced from proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed and backfilled at the Contractor's expense.

1. Back-Siphonage to be Prevented: 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. The Contractor shall be required to install any temporary blow-offs at the ends of all mains as required by the Owner or Engineer.

11.1.15 SETTING HYDRANTS:

A. General Location: Hydrants shall be located in a manner to provide complete accessibility, and in such manner that the possibility of damage from vehicles or injury to pedestrians will be minimized in accordance with AWWA Manual M31, latest edition. Unless otherwise directed, the setting of any hydrant shall conform to the following:

1. Location Re-Curb Lines – When placed behind curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 18 inches, nor more than 30 inches from the gutter face of the curb, or less than 20 feet from the curb line intersection of any street.

2. Location Re-Sidewalk – When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 12 inches of the sidewalk.

B. Position of Nozzles: All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb with the pumper nozzle pointing normal to the curb. They shall conform to the established grade, with nozzles no less than 18 inches nor more than 24 inches above final surface ground elevation. Safety flange shall be approximately 2-3 inches above finished ground surface level to provide access to bolts and nuts. Hydrants shall not be buried below the manufacturer's bury line on hydrant, nor shall bury line exceed 3" above finished grade.

C. Connection to Main: Each hydrant shall be connected to main pipe with a 6 inch ductile iron branch. Each fire hydrant shall be controlled by an independent 6 inch gate valve.

D. Drainage at Hydrant: A drainage pit 2 feet in diameter and 2 feet deep shall be excavated below each hydrant and filled completely with coarse gravel or broken stone mixed with

coarse sand, under and around the bowl of the hydrant and to a level 6 inches above the waste opening. No hydrant drainage pit shall be connected to a sewer.

E. Anchorage for Hydrant: The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench and shall be tied to the main line by means of an anchoring tee and mechanical joint retainer glands (mega-lugs and/or field-loc gaskets). In lieu of a mechanical restrained system, with prior approval of Owner or Engineer, a concrete backing (thrust blocks) may be installed. In no case shall the waste opening be obstructed from free drainage. End of line hydrants must be connected to a minimum of 36-feet of restrained joint ductile iron pipe.

F. Cleaning: Hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

G. Determination of Fire Hydrant Locations: Exact locations of fire hydrants shall be determined in the field to best suit field conditions. It is the intent to locate fire hydrants at property lines between lots, if practical and possible.

H. Alignment of Hydrant: The Contractor shall check each fire hydrant installation with a level to ensure that it is installed plumb. Any fire hydrants improperly located, not plumb or improperly installed and backfilled shall be removed and properly reinstalled at the Contractors expense.

11.1.16 PLUGGING DEAD ENDS:

A. Standard plugs shall be inserted into the bells of all dead ends of pipes, tees, or crosses, and spigot ends shall be capped. Plugs or caps shall be jointed to the pipe or fittings in the appropriate manner.

11.1.17 ANCHORAGE OF BENDS, TEES AND PLUGS:

A. Limiting Pipe Diameter and Degree of Bend: Reaction or thrust backing shall be applied on all pipelines 4 inches in diameter or larger at all tees, plugs, caps and at all bends. Movement shall be prevented at fittings by use of thrust restraint or by attaching mechanical joint retainer glands, or other approved anchorage as indicated on the Plans. Refer to standard detail drawings.

B. Thrust Restraint: All tees, caps, bends or any other locations where unbalanced forces exist shall be anchored by adequate thrust blocking as defined herein. Concrete for thrust blocking shall be Class "B" concrete (3,000 psi) and shall be placed against undisturbed earth. The backing shall be so placed that the pipe and fitting joint will be accessible for repairs. "Sakrete" is not acceptable for thrust blocking. A minimum of one-third (1/3) cubic yard of concrete for each thrust block shall be used and minimum surface area, in square feet, against undisturbed earth shall be taken from the following table for horizontal bends (table based upon 160 psi test pressures). Where weak soil conditions or higher test pressures are encountered, the bearing area of each thrust block will be increased as required by the Engineer or Inspector.

Pipe Size	**Plug or Tee**	**90 ^{0}**	**45 ^{0}**	**22 ½ ^{0}**	**11 ¼ ^{0}**
4"	1.1	1.5	1.1	1.0	1.0
6"	2.2	3.2	1.7	1.1	1.0
8"	4.1	5.7	3.1	1.6	1.1
10"	6.3	9.0	4.9	2.6	1.3

12”	9.1	12.8	7.1	3.6	1.8
16”	16.0	22.7	12.4	6.4	3.2
18”	20.3	28.8	15.6	8.1	4.1
24”	36.3	51.2	28.0	14.5	7.3
36”	81.4	115.0	62.3	31.8	16.0
48”	144.8	204.7	110.8	56.5	28.4

a. The Contractor shall insure that all bolts, nuts, and retainer glands, except on dead-end stubs, are left clear of concrete thrust blocking for future access. Plywood or other suitable means of confining the concrete and keeping the bolts and nuts clear shall be used, and any excess concrete shall be removed at the Contractor’s expense.

b. Vertical bends where the installation of concrete thrust blocks is difficult or impossible shall be secured by the use of retainer glands and/or threaded rods. Where required by the Inspector or Engineer, the Contractor shall verify tightening torques on any and all retainer glands by use of a torque wrench.

c. Thrust ties may be required in some instances by the Inspector or Engineer. Where so required, the Contractor shall provide threaded rods, galvanized steel (A-36) or equivalent, with a minimum diameter of ¾ inch. Threaded rods shall be installed using approved harness assembly or special bolts or plates so designed for this purpose.

d. Following installation, threaded rods and nuts shall be coated with coal-tar epoxy paint for protection from rust and corrosion.

e. Dead end stubs shall be anchored into wall of ditch, against undisturbed soil, with concrete and set screw rings (“mega-lug” or “grip ring” retainer glands) in lieu of backing plug at the end of the line, unless otherwise approved.

11.1.18 CHLORINATION OF COMPLETED PIPELINE:

A. Before placing into service, all new water distribution systems, or extensions to existing systems, or any valved section of such extension or any replacement in the existing water distribution system shall be chlorinated in strict accordance with AWWA C651. Any of the following methods of procedure shall be followed, subject to the approval of the Engineer.

1. Liquid chlorine gas-water mixture

2. Direct chlorine feed

3. Calcium hypochlorite and water mixture

B. Preliminary Flushing: All dirt and foreign matter shall be removed by a thorough flushing through the hydrants, or by other approved means. Each valved section of newly laid pipe shall be flushed independently.

C. Liquid Chlorine: A chlorine gas-water mixture shall be applied by means of a solution-fed chlorinating device, or, if approved by the Engineer, the gas shall be fed directly from a chlorine cylinder equipped with proper devices for regulating the rate of flow and the effective diffusion of gas within the pipe. (Chlorination with the gas-water mixture is preferred to direct feed.)

D. Point of Application: The preferable point of application of the chlorinating agent shall be at the beginning of the pipeline’s extension, or any valved section of it, and through a

corporation stop inserted in the horizontal axis of the newly laid pipe. The water injector for delivering the gas-water mixture into the pipe shall be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. In a new system, application may be at the pumping station, or the elevated tank, or the standpipe, or the reservoir, if available. If a supply of water is not available, the Contractor shall haul the water by tank truck or other means. All water used for testing or chlorinating shall be approved by the Engineer. No additional payment will be made to the Contractor for hauling water.

E. Rate of Application: Water from the existing distribution system or other source of supply shall be controlled to flow very slowly into the newly laid pipeline during the application of chlorine. The rate of chlorine gas-water mixture flow shall be in such proportions to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall be at least 40 to 50 ppm.

F. Back Pressure Prevented: Back pressure, causing a reversal of flow in the pipe being treated, shall be prevented.

G. Retention Period: Treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours and preferably longer as may be directed. After the chlorine treated water has been retained for the required time, the chlorine residual at pipe extremities and at other representative points shall be at least 25 ppm.

H. Chlorinating Valves and Hydrants: In the process of chlorinating newly laid water pipe, all valves and other appurtenances shall be operated while the pipe is filled with the chlorinating agent.

I. Bacteriological Tests: Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed and shall be tested by a state certified laboratory for bacteriological quality in accordance with AWWA C651 "Disinfecting Water Mains". The samples shall show the absence of coliform organisms. As required by the Health Department, two sets of results will be required.

1. Samples shall be taken at locations selected by the Engineer but not less than 1 sample shall be collected for every 1,200 feet of pipe or 1 sample from each dead end line, whichever is greater. Samples may be taken at fire hydrants.

2. If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be reflushed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated until tests show the absence of coliform organisms. There will be no additional cost to Owner for subsequent chlorination and retesting. Copies of all bacteriological tests shall be furnished to the Engineer.

J. Final Flushing: Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline. Where the discharge of heavily chlorinated water will cause damage to the environment, the Contractor shall obtain and apply sufficient quantities of reducing agent to neutralize the remaining chlorine residual. Discharge of chlorinated water shall conform to all local, state and federal regulations. Dechlorination shall be performed at the Contractor's expense.

K. Forms of Chlorine for Disinfection in Water: On approval of the Engineer, a mixture of either calcium hypochlorite of known chlorine content and water may be substituted as an alternative for liquid chlorine.

1. Calcium hypochlorite (comparable to commercial products known as "HTH", "Perchloron" and "Maxochlor") or

2. Sodium hypochlorite conforming to AWWA B300 may be used.

L. Proportions of Calcium Hypochlorite and Water Mixtures: A 5 percent solution shall be prepared, consisting of 5 percent of either powder to 95 percent of water by weight.

M. Application: This calcium hypochlorite or sodium hypochlorite and water mixture shall be injected or pumped into the newly laid pipe under conditions heretofore specified for liquid chlorine application, after preliminary flushing.

N. Approval: Provisions for final flushing, testing, and approval under this alternative shall be the same as those described previously.

O. Procedure When Cutting into Existing Pipelines: Cuts made in existing pipelines for the insertion of valves, fittings, repairs, or for any other purpose shall be chlorinated by shaking a predetermined quantity of the powder into the pipe on each side of the cut-in. After slowly filling the section and reversing the flow, the chlorinated water shall be retained for several hours, then flushed until no odor of chlorine can be detected in the wastewater, or residual chlorine as provided for herein.

P. Resumption of Service: After satisfactory chlorination by any of these alternative procedures, the consumer may be served from the newly laid pipeline or the service may be resumed on existing pipelines after authorization is received from the health agency having jurisdiction.

11.1.19 HYDROSTATIC TESTING:

A. General: After the pipe has been laid and backfilled as specified, all newly laid pipe, or any valved section of it shall, unless otherwise specified, be subject to hydrostatic testing, which shall include pressure testing and leakage testing. No pressure test shall be conducted until all taps have been installed and all thrust blocking has been in place for a minimum of 48 hours. Unless otherwise directed, all valves within the section being tested shall be open during the pressure test, including all service connections, fire hydrant control valves, and dead end valves. Hydrostatic testing shall conform to all requirements of the agency having jurisdiction. Hydrostatic testing shall also conform to the requirements of AWWA C600 for ductile iron pipe and AWWA C605 for PVC pipe, unless otherwise specified herein. In general, the requirements of AWWA will apply whether ductile iron or PVC pipe is used.

1. Test Pressure: For both ductile iron pipe and PVC pipe, the test pressure shall be at least 150 psi and shall not exceed pipe, valve, or thrust restraint design pressures. The pressure shall not vary by more than ± 5 psi for the duration of the test.

B. Pressurization: Each section of pipe shall be slowly filled with water and the specified test pressure, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. If at any time during the pressure test, the pressure drops more than 5 psi, then pump back to test pressure and record amount of water

required to restore the system to test pressure. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Contractor.

C. Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air release valves are not located at all high points, the Owner shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation stops shall be closed and the test pressure applied. After pressure testing, the corporation stops shall be removed and plugged. The installation and removal of corporation stops for testing shall be done by the Owner at the Contractor's expense. See Paragraph entitled "Tapping of Water Mains" in this Section.

D. Duration of Pressure Test: The duration of each pressure test shall be until the line has been completely inspected for visible leaks, but in no case shall the pressure test duration be less than six hours.

E. Recording Pressure Gauge: A recording pressure gauge shall be used during the pressure test. Charts shall be turned over to the Engineer.

F. Examination: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined by the Contractor carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Owner.

G. Allowable Leakage Testing: Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage. The Contractor shall utilize the form, as required by MAWSS, for Water Main/Services Pressure/Leakage Test to record project specific information and document the test data and test results. The completed form shall be submitted to Engineer and MAWSS bearing the signature of the Contractor and the approval signature of the Engineer and MAWSS Inspector. No pipe installation will be accepted until or unless this leakage (evaluated on a pressure basis of 150 psi) is less than allowable leakage in the following formula:

$$L = \frac{SD(P)1/2}{148{,}000}$$

L = allowable leakage in gallons per hour

S = length of pipe tested, in feet

P = average test pressure during the leakage test, in pounds per square inch gauge

D = nominal diameter of the pipe in inches

H. Leakage defined: Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section of it, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled, for the duration of the leakage testing. Contractor shall utilize a hydrant meter provided by MAWSS to record water usage for testing and shall pay for water quantity used.

I. Acceptance of Installation: No pipe installation will be accepted unless leakage is within the limits specified herein. If any test of pipe laid discloses leakage greater than that specified, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance.

J. Visible Leaks: The Contractor, at his expense shall locate and repair all defective joints, connections, sections, or valves until the leakage is within that allowed, regardless of the amount of leakage. After the Contractor has made the necessary corrections, the main shall be retested until the line passes the necessary requirements.

K. Scheduling and Implementation of Testing: All pressure tests shall be scheduled at least 24 hours in advance and shall be conducted in the presence of the Engineer and/or Owner. The Contractor shall notify the Engineer or Owner prior to each testing. Pipe may be subjected to pressure testing and leakage testing at any convenient time after partial completion of backfill. Segments of water lines to be connected to existing water lines shall be chlorinated, flushed and checked for absence of bacteria before the new section of line is pressure tested.

L. The Contractor shall not rely on the existing system valves to not leak or hold test pressure. It shall be the Contractors responsibility to install, within one joint of pipe to connection point or points, temporary caps or valves to be used in conducting the pressure tests. The Contractor may at his option pressure test the line before chlorination, provided the new line is not connected to the existing line during the pressure test. This procedure is set forth to prevent contaminated water or water with high chlorine content from being forced into a line in service through a faulty valve or other device during pressure tests.

M. Tapping Valves: Resilient seated tapping valves require testing with the valve closed and no allowable leakage.

N. For metal seated tapping valves, the following procedure shall be followed:

1. The tapping valve and sleeve shall be tested using a mechanical joint plug, with valve open in position, and shall have zero allowable leakage.

2. The tapping valve shall be closed, mechanical joint plug removed, and pressure maintained on the sleeve side of the tapping valve gate. Allowable leakage shall be 1-ounce of water per inch diameter per hour. This same allowable leakage may be added to the total allowable leakage for the section of water main to be pressure tested following installation.

11.1.20 CONCRETE:

A. The minimum compressive strength required at 28 days is 3,000 pounds per square inch. Field specimens and laboratory tests shall be made in accordance with the standards of the American Society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed 6 U.S. gallons per sack of cement. Slump shall range between 2 and 5 inches.

11.1.21 BACKFILLING:

A. See Section 15 entitled “Backfilling”.

11.1.22 EROSION CONTROL:

A. See Section 16 entitled “Erosion Control” for “Topsoil”, “Grassing and Mulching”, “Seeding”, “Solid Sod”, “Riprap”, “Foundation Material”, “Timber Ditch Checks”, “Erosion Control Netting”, “Silt Fence” and “Hay Bales”.

11.1.23 MAINTENANCE OF SURFACES:

A. Following the certification of completion by the Engineer, the Contractor shall maintain the surface of the unpaved trenches, adjacent curb, sidewalks, gutters, shrubbery, fences, sod and other surfaces disturbed for a period of 3 months thereafter; and shall maintain the repaved areas (if paved by Contractor) and adjacent curbs, gutters and sidewalks for 1 year after said certification. All material and labor required for the maintenance of the trenches and adjacent structures shall be supplied by the Contractor and the work shall be done in a manner satisfactory to the Owner.

11.1.24 CLEAN-UP:

A. See Section 10 entitled “Special Provisions”, Paragraph entitled “Clean-Up”.

11.1.25 PRESSURE TESTS AND CHLORINATION ADJACENT TO EXISTING WATER LINES

A. Sections of water lines adjacent to existing water lines that are in service shall be chlorinated, flushed and checked for absence of bacteria before the new section of line can be pressure tested. The Contractor may at his option pressure test the line before chlorination, provided the new line is not connected to the existing line during the pressure test. This procedure is set forth to prevent contaminated water or water with high chlorine content from being forced into a line in service through a faulty valve or other defect during pressure tests.

11.1.26 EXISTING WATER SYSTEM:

A. The Contractor shall protect, maintain, and keep in service all existing water lines and service connections during construction operations on the new water lines. Any existing lines cut or damaged shall be reported immediately to the Engineer or Owner, repaired by the Contractor immediately and the service restored on the existing lines.

B. Any cost incurred by the Owner to address MAWSS facilities damaged by the Contractor shall be billed to the Contractor.

11.1.27 DUST CONTROL:

A. See Section 7 entitled “Legal Relations and Responsibility to Public”, Paragraph entitled “Dust Control”.

11.1.28 PUBLIC SAFETY:

A. All water line materials unloaded on the job sites shall be placed in areas well away from the traveling public in order to avoid hazardous conditions.

11.1.29 EXTRA DEPTH FOR WATER LINES:

A. Water lines shall be laid below existing drainage pipes, existing water lines, gas lines, and other utility lines, by deflecting pipe downward, unless otherwise shown on the Plans. There

will be no extra payment made for extra depth of water line required to go under the existing drainage pipes and utilities.

11.1.30 HOT TAPPING AND INSERT-A-VALVE:

A. Tapping of existing water mains shall be performed by the Owner, unless otherwise required by the Owner, where such taps are indicated on the Plans or required for connection of new lines to existing lines. The Owner will furnish tapping valves, and tapping sleeves, required for the tap. The Owner shall make all wet taps on existing waterlines and shall furnish all tapping valves and sleeves. The Contractor shall pay for all wet taps in advance of the work. The Contractor shall perform all excavations, backfill, removing and replacing pavement and incidentals necessary for the tap. Valve stem extensions, when required as hereinafter specified, and valve boxes shall be furnished by the Contractor. Insert-a-valve installation shall also conform to the above requirements.

B. Corporation stop outlets required for testing and chlorination of new water mains will be furnished and installed by the Owner at the Contractor's expense. The Contractor shall perform all excavation, backfill, removing and replacing pavement and incidentals necessary for installations of corporation stop outlets.

C. The cost of making taps or installation of corporation stop outlets shall be billed to the Contractor at a price to be established prior to submission of bids. Bidders shall contact the Owner during regular working hours to obtain the cost of various taps or outlets for the respective projects. Failure to obtain the prices prior to submission of bids shall in no way relieve the Contractor of paying the prevailing price for the various taps and outlets.

11.1.31 ENCASEMENT PIPE:

A. See Section 17 entitled "Encasement Pipe".

11.1.32 BACKFLOW PREVENTION:

A. See Board Policy and Procedure Manual, Section 6, Backflow Prevention Program.

11.1.33 FIRE LINE INSTALLATIONS:

A. All fire lines and private fire sprinklers shall have an approved backflow prevention device (BFP) installed to protect the public water supply. All fire lines shall require the installation of an approved double check BFP with approved fire meter.

B. All FDC (Siamese Connections) shall be installed within 100 feet of a public fire hydrant and at a distance greater than 40 feet from the building, unless otherwise approved by the Fire Department.

C. All fittings and backflow devices, on both the domestic and fire line, will be the responsibility of the owners or their representatives.

END OF SECTION