

SECTION I

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SECTION I

(2008)

WATER SYSTEM SPECIFICATIONS

1. PURPOSE AND GENERAL REQUIREMENTS

1.1 Purpose

This publication is to provide information to all Engineers, Contractors, Builders, Developers and other interested persons or firms, on the District requirements with respect to design and construction of water systems within the District. This publication presents technical specifications for the design and installation of water mains and should be used in conjunction with the Latest revision of the District Master Plan and District Rules and Regulations by any firm or individual planning to design or construct water systems within the District. In all cases in these specifications where reference is made to "District Engineer," the "District Engineer" shall mean any representative designated by the District to provide inspection of the water system construction.

1.2 General Requirements

1.2.1 All water mains shall be profiled on the construction plans. All water mains 16" and larger shall be ductile iron.

1.2.2 All contractors must notify the District Engineer at least 48 hours prior to start of construction.

1.2.3 A pre-construction meeting must be arranged by the contractor and held prior to the start of any work. The District Engineer, Contractor, and Owner or Owner's Engineer must be represented at this meeting, which will be held at the District office.

1.2.4 Approved construction plans and a copy of these specifications must be kept on the job site by the Contractor at all times. Approved construction plans will expire 6 months from date of approval if construction has not begun.

1.2.5 No work shall be backfilled (including bedding material above the spring line of the pipe) until the construction has been inspected and approved for backfilling by the District Engineer.

1.2.6 The maximum distance between main line gate valves shall be 600 feet. Gate valves shall be located so that no more than 15 lots will be out of service with the closing of any two (2) valves. Gate valves must be placed so that no more than 1 fire hydrant will be out of service with the closing of any (2) valves. Gate valves

shall also be located at all intersections.

1.2.7 Only Badger meters shall be used.

1.2.8 Fire hydrants shall have NST (National Standard Thread) and shall be installed and spaced in accordance to the Parker Fire District.

1.2.9 Steel pipe installed only with prior approval of the District Engineer.

1.2.10 Water mains shall be located a minimum distance of 5.0 feet from the lip edge of the gutter pan. Water mains shall be located on the northern or eastern side of the street.

1.2.11 Squeegee bedding shall be used.

2. LOCATION OF LINES AND APPURTENANCES

2.1 Water Mains in Streets

When the water mains are placed in streets, they shall be placed as follows:

2.1.1 On streets running north and south, the water main shall be placed 10' (ten feet) east of the centerline of the street.

2.1.2 On streets running east and west, the water main shall be placed 10' (ten feet) north of the centerline of the street.

2.1.3 On streets shaped as a "U" or on streets having unusually sharp turns, the water main will conform to the above specifications as near as practical, but the final location shall be as determined by the District Engineer or his representatives.

2.2 Water Mains in Easements

In areas where water mains are placed in easements, all water mains shall be located within the easements shown on the approved drawings. All water main easements must be a minimum of 30' (thirty feet) in width for exclusive easements or 50' (fifty feet) for non-exclusive easements. No trees, structures or fences of any kind will be allowed within the easements. No water line shall be located less than 5' (five feet) from the edge of an easement. Fire hydrants must have an easement envelope around them measuring 5' (five feet) behind the hydrant and 10' (10 feet) to the sides.

2.3 Valves

Valves shall be located, where possible, at a point on the main that would be intersected by the extension of a property line.

2.4 Fire Hydrants

Fire hydrants shall be located, where possible, on the northeast corner of an intersection a minimum of 18" behind the curb or sidewalk, or a minimum of 24" inside the street right-of-way, and set on the curb return. Where this is not possible, fire hydrants shall be located as directed by the District Engineer. All fire hydrant street valves shall be 6" and shall be located at, or within 3' (three feet) of, tee from the main line. See "Valve and Fire Hydrant Location Detail," Section I.

3. PIPE

3.1 General

All public water mains will be a minimum of 6" in diameter. Sizing shall be determined by the District Engineer. Pipe in sizes 10" or 14" generally will not be allowed. Additional requirements for type of pipe shall be determined by the District Engineer.

3.2 Ductile Iron Pipe

All ductile iron pipe furnished under this specification shall be manufactured in strict accordance with AWWA C151 thereof with the following additional requirements:

3.2.1 Size of Pipe - This specification shall cover 6", 8", 12", and 16" diameter pipe.

3.2.2 Joint Type - All ductile iron pipe joints shall be "Restrained Push on joint single gasket" or "Mechanical joint single gasket."

3.2.3 Thickness Class - See Materials Specifications.

3.2.4 Laying Length - Pipe furnished shall have a normal laying length of 18' or 20'.

3.2.5 Grade of Iron - Iron used in the manufacture of pipe shall have 60/42/10 physicals.

3.2.6 Cement Mortar Lining - See Materials Specifications.

3.2.7 Polyethylene Wrapping - See Materials Specifications.

3.3 Polyvinyl Chloride (PVC) Pressure Pipe

All polyvinyl pipe furnished under this specification shall be manufactured in strict accordance with AWWA Standard C 900 DR 14 and shall conform to the following additional requirements:

3.3.1 Size of Pipe - This specification shall cover polyvinyl chloride pipe in 6-inch,

8-inch, and 12-inch nominal diameters with cast iron pipe equivalent outside diameters.

3.3.2 Joint Type - Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.

Solvent cement joints are strictly prohibited.

3.3.3 Class and Type - See Materials Specifications.

3.3.4 Pipe Lengths - Each length of pipe will be a standard laying length of 20 feet. Random lengths shall not be acceptable.

3.4 Reinforced Concrete Pipe

Reinforced concrete pipe shall be installed in sizes larger than 24" only. Specifications for RCP must be submitted for review by the District Engineer prior to approval and use.

3.5 Polyethylene Wrapping

See Materials Specifications.

4. WATER MAIN EQUIPMENT

4.1 Fittings- See Materials Specifications.

4.2 Valves

4.2.1 Gate Valves - Valves shall have 2" square operating nuts and shall open clockwise (right) unless otherwise directed by the District Engineer. See Materials Specifications.

4.2.2 Butterfly Valves - Operator manholes shall be provided. Valve operators shall have 2" square operating nuts and shall open clockwise (right). See Materials Specifications.

4.2.3 Fire Hydrants - Hydrants shall have a 6" bell connection, two 2-1/2" hose connections and one 4-1/2" pumper connection. Threads on the pumper and hose connections shall conform to the "National Standard Screw Threads for Fire Hose Couplings and Fittings" published by the Insurance Services office. Fire hydrants shall be cast iron and bronze mounted. Fire hydrants shall have auxiliary 6" gate valve anchored directly to or as near as possible to the main line tee as shown in the details in Section I. The hydrant lateral shall be 6" ductile iron, shall be wrapped in

polyethylene, and shall be rodded or mechanically restrained from tee to hydrant shoe. See Materials Specifications for Approved Fire Hydrant Manufacturers.

4.2.4 Check Valves - shall be of the swing check type and shall be used wherever the flow of water must be in one direction only and reverse flow must be prevented. Check valves shall be of the outside spring and lever type and shall be installed in vaults or manholes. Check valves shall be furnished with flanged end connections and shall be installed in a manner that allows easy access for inspection, adjustment and maintenance.

4.2.5 Valve Boxes and Valve Markers - shall be installed in accordance with the details in Section II. Markers shall be installed to locate all valves on lines in easements or other rights-of-way when not in paved streets. Fire hydrant auxiliary valves shall not be marked unless specifically directed by the District Engineer.

4.2.6 Combination Air Relief-Vacuum Breaker Valves - shall be installed at each high point on all water mains and at all other locations as directed by the District Engineer. See Materials Specifications.

4.2.7 Pressure Reducing and Regulating Valves - Pressure reducing and regulating valves shall be of a type capable of maintaining pre-adjusted downstream pressures, varying rates of flow and upstream pressure without causing water hammer. Valves shall be diaphragm type, not spring operated, with flanged end connections, and shall be installed in concrete valve vaults of sufficient size to provide adequate maintenance and operation. Valves shall have gate valves and pressure gauges on both upstream and downstream sides and shall have bypasses with smaller pressure reducing and regulating valves to handle minimum flows as determined by the District Engineer. All gate valves in the vaults shall be capable of being operated from above ground by use of 2" square valve keys. See Materials Specifications.

4.2.8 Blow-Off Assemblies - Blow-off assemblies shall be installed at each low point in all water mains and on all major transmission lines. All water mains having dead ends where stagnant water may collect shall be provided with blow-off devices in accordance with the details in Section I. If the main will be temporarily deadened, a blow-off shall be installed. If a fire hydrant is located at the main's temporary end, then it may serve as the blow-off.

4.2.9 Rods and Clamps - All tees, bends, valves, plugs, reducers, and fire hydrants shall be rodded and clamped in accordance with the details in Section I. Rods and socket clamps shall be used on ductile iron and polyvinyl chloride pipe systems. Where polyvinyl chloride pipe is used and the plug or bend is to be rodded, ductile iron pipe shall be installed on either side of the fitting and socket clamps shall be placed on the iron pipe. No socket clamps shall be clamped to polyvinyl chloride pipe. Where mechanical joint iron pipe is used, rods may be bolted through the joint bolt holes. Number and size of rods shall be as indicated in the details. All rods and

clamps shall be coated with coal tar epoxy or polyethylene wrapped. In all cases where reducers with a reduction ratio equal to or greater than 2 to 1 are used, special rodding and clamping procedures may be required by the District Engineer. Mega-Lugs are allowed through 24" sizes.

4.2.10 Thrust Blocks - Concrete thrust blocks shall be installed at all tees, plugs, bends, and fire hydrants in accordance with the details in Section I. Where thrust blocks are used to block plugs or valves or as indicated by the District Engineer, the valve or plug shall be protected from concrete by an 8 mil thickness of polyethylene. Size of thrust block and dimensions shall be in accordance with the details in Section I. The concrete used for the thrust blocks shall be 3000 psi, 28 day strength. Thrust blocks shall be installed in addition to rods and clamps, on all dead-ends, valves, tees, bends, fire hydrants, and plugs.

4.2.11 Pre-Cast Concrete Vaults and Manholes - All butterfly valve manholes, air relief and vacuum valve vaults, pressure reducing valve vaults, meter vaults, and other vaults shall be pre-cast or poured in place concrete. Design of manholes shall be for traffic loading and shall include aluminum rungs, sump pit, cast iron rings and covers of a pattern approved by the District Engineer, with the word "water" cast thereon. All vaults and manholes shall be water tight and all joints, pipe openings, and other places where infiltration could exist shall be sealed from the outside with a mastic waterproof sealant. All inside joints shall be grouted.

5. ENCASEMENT AND CASINGS

5.1 Pipe Casings - shall be used where bores are required under rights-of-way by the using agency. All pipe casings shall be constructed to conform to the details in Section I. The type of casing material and its properties shall have prior approval from the District Engineer before using.

5.2 Protective Concrete Pads Over Pipe - shall be used over pipe to protect it from traffic and frost when, under unusual circumstances, it becomes necessary to lay pipe at shallow depths. The pads shall be designed such to support loads from traffic without transmitting the impact or load to the pipe. The concrete pads can only be used if prior approval has been given by the District Engineer.

6. INSTALLATION

6.1.1 General - Excavation for pipelines, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the same as shown on the approved drawings or as otherwise approved by the District Engineer. Any water that may be encountered or may accumulate in the excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the excavation free and clear of water during the progress of the work.

6.1.2 Limit of Excavation - Except by expressed written permission of the District Engineer, the maximum length of open trench shall be 600', or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is smaller. The distance is the collective length at any location, including open excavation, pipe laying and appurtenances, construction and backfill that has not been temporarily resurfaced. No trench shall be left open at any time that the Contractor is not on the job site engaged in construction operations.

6.1.3 Trench Width - The overall trench width shall not be more than 24" nor less than 12" wider than the largest outside diameter of the pipe to be laid therein, measured at the top of the pipe, exclusive of branches. Excavating and trenching shall be true to line so that a clear space of not more than 12" or less than 6" in width is provided on each side of the largest outside diameter of the pipe for proper placement and densification of the bedding or backfill. For the purpose of this section, the largest outside diameter shall be the outside diameter of the bell, on bell and spigot pipe. All trenching sizes shall be in accordance with the Bedding Details in Section I.

6.1.4 Excavation Below Grade - The trench shall be excavated to a minimum depth of 6" below the bottom of the pipe. Before the pipe is laid, the subgrade shall be made by backfilling with an approved material in 3" uncompacted layers. The layers shall be thoroughly tamped as directed by the District Engineer so as to provide a continuous bearing and support for the pipe at every point between coupling or bell holes, except that it will be permissible to disturb and otherwise damage the finished surface over a maximum length of 18" near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. The finished subgrade shall be prepared accurately by means of hand tools.

6.1.5 Trenching By Hand or Machine - Hand methods for excavation shall be employed in locations directed by the District Engineer. In other locations, the Contractor may use trench digging machinery or employ hand methods.

6.1.6 Bracing Excavations - All excavations shall be properly supported in the manner as required by Occupational Safety and Health Administration Federal Register Vol. 37, No. 243, Sub-part P, Section 1926.652 or as required by State laws and Municipal ordinances and as may be necessary to protect life, property, the work. Excavations shall be braced, sheeted and supported such that they will be safe, and the ground alongside the excavation will not slide or settle. Excavation shall be so braced or sheeted so as to provide conditions under which workmen may work safely and efficiently at all times. The sheeting, shoring and bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.

Care shall be exercised in the drawing or removing of sheeting, shoring, bracing and timbering to prevent the caving or collapsing of the excavation faces that are being supported.

6.1.7 Grading and Stockpiling - The Contractor shall control grading in a manner to

prevent water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm and wastewater can be uninterrupted in existing gutters, other surface drains or temporary drains.

6.2 Dewatering

The Contractor shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods that will insure a dry excavation and preservation of the bottoms of excavations. Said methods may include well points, sump pumps, suitable rock or gravel placed below the required bedding for drainage and pumping purposes, temporary pipelines and other means, all subject to the approval of the District Engineer. Dewatering for the water lines shall commence when groundwater is first encountered, and shall be continuous until such time as water can be allowed to rise in accordance with the provisions of this section.

The Contractor shall dispose of the water from the work in accordance with State and Federal laws and with respect for adjacent properties and new construction.

6.3 Foundations and Bedding

6.3.1 Foundations in Poor Soil - If excessively wet, soft, spongy, unstable or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall be removed to a depth as determined in the field by the District Engineer and in accordance with the Bedding Details, Section I.

6.3.2 Foundations in Rock - Where rock is encountered, it shall be removed below grade and the trench backfilled with rock uniformly graded between 3/4-inch and 1-1/2-inches to provide a compacted foundation cushion with minimum allowable thicknesses of 3" under the outside diameter of the pipe bell and 6" under the pipe barrel. Material, other than what has been stated, can be used if accepted by the District Engineer and necessary agencies. Whether or not the foundation material will be considered as rock and require bedding as described above will be determined by the District Engineer.

6.3.3 Pipe Clearance in Rocks - Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6" below and on the side of the pipe and fittings.

6.3.4 Bedding Procedure - The pipe shall be carefully bedded as shown in the Bedding Details in Section I. The Contractor shall be responsible for accurately

shaping the pipe subgrade to fit the bottom of the pipe for the width shown on the Bedding Details. Use of the drag template shaped to conform to the outer surface of the pipe will be required if other methods do not give satisfactory results.

Each joint shall be recessed in bedding material as required by the Bedding Detail in such a manner as to relieve the bell or coupling of the pipe of all load and to insure continuous bearing along the pipe barrel upon the pipe sub-grade.

The pipe bedding, using either squeegee or clean imported sand shall conform to the limits set by the District Specifications. The bedding material, either squeegee or imported sand, shall be compacted by approved methods to a Standard Proctor Density of 90% in open areas (AASHTO T-99) and 95% in all Public R.O.W. (AASHTO T-99). It shall be brought to an optimum moisture content and shall be placed by hand in layers not exceeding 3" in thickness to the centerline (springline) of the pipe and each layer shall be solidly tamped with the proper tools so as not to injure, damage or disturb the pipe. Backfilling shall be carried on simultaneously on each side of the pipe to assure proper protection of the pipe. Water settling for compaction may be approved by the District Engineer in the event the foundation and bedding materials are sufficiently granular and sandy in nature that the required compaction will be obtained. The material may also need to be removed and replaced. From the springline of the pipe to a distance 12" above the top of pipe, the bedding material must be placed in layers not to exceed 12".

The area shown on the details from trench bottom to 12" above this pipe shall be called the "pipe zone."

6.4 Installation of the Water Pipe

6.4.1 General - All pipe shall be laid without break from fitting to fitting. Pipe shall be laid to the line and, where required, grade, as shown on the approved plans and in such a manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the line. Where possible, vertical deflections shall be made at pipe joints and vertical bends shall be eliminated. Permissible joint deflections are specified in paragraph 6.4.3.7. The interior of the water pipe shall be cleaned of all dirt and superfluous material of all description as the work progresses.

At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hour as well as overnight.

6.4.2 Alignment and Grade - The water line shall be laid and maintained to the required lines and grades as shown on the plans.

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the approved plans is

required, the District Engineer shall have the authority to change the plans and order a deviation from the line and grade. Any changes to the plans in the field must be marked clearly on the plans and signed and dated by the District Engineer.

6.4.3 Laying of Pipe

6.4.3.1 Lowering of Water Main Material Into Trench -Proper implements, tools and equipment satisfactory to the District Engineer shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece in such a manner as to prevent damage to the water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the District Engineer's attention.

6.4.3.2 Inspection Before Installation - All pipe and fittings shall be carefully examined for cracks and other defects while suspended and before installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the District Engineer, who will prescribe corrective repairs or rejection.

6.4.3.3 Cleaning of Pipe and Fittings - All lumps, blisters and excessive coating shall be removed from the bell or coupling and spigot ends of each pipe, and the outside of the spigot and the inside of the bell or coupling shall be wire brushed and wiped clean and dry and free of oil and grease before the pipe is laid.

6.4.3.4 Laying of Pipe - Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipelaying crew cannot put the pipe into the trench and place it without getting earth into it, the District Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size, or plastic caps, shall be placed over each end and left there until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell or coupling and the pipe forced home and brought to correct line

and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells or couplings. Precautions shall be taken to prevent dirt from entering the joint space.

6.4.3.5 Cutting of Pipe - The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

6.4.3.6 Bell or Coupling Ends to Face Direction of Laying - Pipe shall be laid with the bell or coupling ends facing in the direction of laying, unless otherwise specified by the District Engineer. Where the pipe is laid on a grade of 10% or greater, the laying shall proceed upward with the bell or coupling ends of the pipe upgrade, if the progression of work allows.

6.4.3.7 Permissible Deflection at Joints - Wherever it is necessary to deflect the pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb stems or where long radius curves are permitted, the amount of deflection allowed shall not exceed that specified in paragraphs 6.4.4.3 and 6.4.5.2 for mechanical joints and push on joints, respectively, and 4 degrees per joint (or 2 degrees on each side of the coupling) for polyvinyl chloride pipe.

6.4.3.8 Insulation Between Different Metallic Pipe Materials - Whenever it is necessary to join pipe or fittings with dissimilar metal, a method of insulating against the passage of electric current shall be provided and shall be approved by the District Engineer.

6.4.3.9 Installation of Polyethylene Wrapping (When Specified). See Detail, Section I.

6.4.3.9.1 Pipe - Where specified in Section 3.6, all ductile iron pipe shall be wrapped with polyethylene wrapping, minimum 8 mil thickness. Suggested installation procedure for polyethylene tube wrapping is as follows:

Pick up the pipe with a sling or pipe tongs. Slip a polyethylene tube that is approximately 2' longer than the pipe over the plain end and leave it bunched up accordion style.

Lower the pipe into the trench and make up the joint with the preceding pipe. Shallow bell holes are required to allow overlap of the tube at the joints. Remove the sling or tong from the center of the pipe, raise the bell a few inches and slip the polyethylene tube along the pipe barrel, leaving approximately 1' of the tube bunched up at

each end of the pipe for wrapping the joints.

Overlap each joint by first pulling one bunched-up tube over the bell, folding it around the adjacent plain end, and securing it in place with two or three wraps of the polyethylene adhesive tape. Complete the overlap by repeating the same procedure with the bunched-up tube on the adjacent pipe.

Take up the slack tube along the pipe barrel by folding it over the top of the pipe holding the fold in place with polyethylene adhesive tape.

Repair any rips, punctures or other damage to the polyethylene with tape or by cutting open a short length of tube, wrapping it around the pipe and securing with tape.

6.4.3.9.2 Fittings - When specified in Section 3.6, all fittings for ductile iron, or polyvinyl chloride pipe shall be wrapped with polyethylene tubing as described above. Installation procedure shall be as follows:

Wrap tees, crosses and other fittings with a flat sheet obtained by splitting open a length of polyethylene tube. Pass the sheet under the valve or fitting and bring it up around the body. Joint the seams by bringing the edges together, folding over twice and securing in place with tape.

Handle slack tube and overlapping at joints in the same manner described above for pipe.

Prepare openings for air reliefs, etc., by making an X-shaped cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

6.4.4 Jointing of Mechanical Joint Pipe

6.4.4.1 Cleaning and Assembly of Joint - The last 8" of the outside spigot and inside bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grease, grit, excess coating and other foreign matter from the joint and then painted with a soap solution made by dissolving 2 cup of liquid soap in 1 gallon of water. The cast iron gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge towards the gland. All mechanical joints and fittings shall be wrapped in polyethylene wrap; see Detail in Section I.

6.4.4.2 Bolting of Joint - The entire section of pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell. Care shall be taken to locate the gasket evenly around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed finger tight. All nuts shall be tightened with a torque limiting wrench. The torque for various sizes of bolts shall be as follows:

Pipe Size (Inches)	(Inches)	Range of Torque	
		Min. (Ft-#)	Max.
3	5/8		45-60
4-24	3/4		75-90
30-36	1		100-120
42-48	1-1/4		120-150

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

6.4.4.3 Permissible Deflection in Mechanical Joint Pipe - Whenever it is desirable to deflect mechanical joint pipe in order to form a long-radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 1 at the end of this section.

6.4.5 Jointing Push-on Joint Pipe

6.4.5.1 Cleaning and Assembly of Joint - The inside of the bell coupling and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket, or the coupling end of polyvinyl chloride pipe.

A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the outside of the spigot end of the pipe or both. Gasket lubricant shall be supplied by the pipe manufacturer and approved by the District Engineer.

The spigot end of the pipe shall be placed into the bell or coupling end, without touching the ground with the spigot end after cleaning. The joint shall then be completed by forcing the plain end to the bottom of the socket. Pipe shall be marked with a depth mark to insure that the spigot end is inserted to the full depth of the joint. Field-cut pipe lengths shall be marked by painting or file mark. The spigot end shall be ground or filed to resemble manufacture pipe end. Complete assembly instructions shall be provided by

the pipe manufacturer.

6.4.5.2 Permissible Deflection in Push-On Joint Pipe - Whenever it is desirable to deflect push-on joint pipe, in order to form a long-radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 2 at the end of this section for cast iron or ductile iron pipe, or 4 degrees coupling for polyvinyl chloride pipe.

6.4.6 Setting of Fittings - Fittings and plugs shall be joined to pipe in the manner specified herein for cleaning, laying and joining pipe.

6.5 Installation of Water Line Appurtenances

6.5.1 Valve Boxes and Valve Vaults - A valve box or valve vault shall be provided for every valve.

A valve box shall be provided for every valve that has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a cast iron grease case. All gate valves 12" and less and all butterfly valves 20" and less shall have valve boxes and all butterfly valves larger than 20" shall have concrete manholes to house the opening if directed by District Engineer. Pressure reducing valves, check valves, and air relief and vacuum breaker valves shall be installed in concrete vaults.

The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or embedded in an 18" square by 6" thick concrete pad when placed in an area that is not paved.

A concrete vault shall be provided for all butterfly valve operators as shown in the details in Section I. The valve nut shall be readily accessible for operation through the opening in the vault, which shall be set flush with the finished surface of the pavement, or shall extend 6" above grade in unpaved areas.

When the water line is connected to the District mains, only District personnel shall operate any gate or butterfly valves.

6.5.2 Valve Markers - All valves installed on the main transmission line with the exception of those on extended property lines, shall be identified with a 4" steel post, and painted yellow, with the distance to the valve and the appropriate identifying initials stenciled in black. Where the valve is to be installed in a vault equipped with a vent pipe, the vent pipe will also serve as a valve marker.

6.5.3 Dead Ends - All dead ends shall be closed with cast iron plugs that shall be rodded to the main line and provided with a kickblock as specified on the details in

Section I. Blow-off valves shall be located as specified in Section 4.2.8.

6.5.4 Fire Hydrants

6.5.4.1 Position - All hydrants shall stand plumb and shall have their pumper nozzles at right angles to the main line, unless otherwise directed by the District Engineer. Hydrants shall be set to established grade, with nozzles at least 18" above the ground, or as directed by the District Engineer. The bottom flange of the hydrant shall be set 3" above the finished grade. No portion of the fire hydrant may protrude into the sidewalk area.

6.5.4.2 Connection to Main - Each hydrant shall be connected to the main with a minimum 6" ductile iron branch controlled by an independent 6" gate valve located next to mechanical joint tee with a 6" anchor coupling. The branch line shall be rodded and wrapped, and the hydrant shoe and main line tee shall be thrust blocked.

6.5.4.3 Hydrant Drainage - A drainage pit 3' in width and 3' deep shall be excavated below each hydrant and filled completely with coarse gravel or crushed stone mixed with coarse sand, under and around the shoe of each hydrant and to a level 6" above the top of the pipe lateral to allow for proper drainage.

6.5.4.4 Lateral Offsets - 6" ductile iron manufactured offsets may be used on the branch line to allow proper elevation settling of the hydrant shoe.

6.5.4.5 Details - All fire hydrant installations shall be in accordance with the details in Section I.

6.5.5 Anchorage - All plugs, valves, bends, reducers, tees, and fire hydrants shall be anchored by thrust blocks and rods and clamps in accordance with Sections 4.2.9 and 4.2.10, and with the details in Section I.

6.5.6 Approved fire hydrants shall be as described in Section 4.2.3 sheet 5 of the Water Details.

6.5.7 Color shall be safety yellow.

6.6 Backfilling

6.6.1 General - All trenches shall be backfilled after pipe, fittings and appurtenances have been installed, inspected and approved by the District Engineer. Bedding and "pipe zone" backfill shall be installed in accordance with Section 6.3.

Whenever a compaction requirement value is specified herein, the optimum moisture

content and Standard Proctor Density shall be determined in accordance with AASHTO T-180 and ASTM D1557 for 90% and AASHTO T-99 and ASTM D698 for 95%.

6.6.2 Density Requirements in Trench - The Contractor shall obtain a Standard Proctor Density of 90% for the total depth of all trenches in open fields and 95% in dedicated rights-of-way. Backfilling shall be done with good sound earth, sand or gravel, and no oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill unless these materials are scattered and do not exceed 6" in any dimension and are not placed within one foot of the 2-1/2' limit. Material of perishable, spongy or otherwise improper nature shall not be used in backfilling and no material greater than 4" in any dimension shall be placed within 1' of any pipe, manhole or structure. Backfilling shall be accomplished in the zone in layers not to exceed 3'. All backfill material shall be subject to the approval of the District Engineer.

6.6.3 Compacted Fill - Compaction shall be done by use of vibratory equipment, tamping rollers, pneumatic tire rollers or other mechanical tampers of the type and size approved by the Engineer. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened and compacted to the specified density in Section 6.6.2. Any damage to the pipe as a result of Contractor's operation shall be repaired and/or replaced.

6.6.4 Consolidated Fill - Consolidated fill shall be performed by flooding, pooling or jetting so as to obtain a relative density of the fill material at least equal to that specified in Section 6.6.2. When flooding, pooling or jetting methods are used, material for use as backfill shall be placed and compacted in layers not exceeding 3' in thickness. Flooding, pooling or jetting methods shall be supplemented by the use of vibratory or other compaction equipment when necessary to obtain the required density. Care shall be taken in all consolidating operations to prevent the movement or floating of the pipe. In the event there is movement or floating, the Contractor shall re-excavate, relay and backfill all pipe so affected. Consolidation methods shall not be used when the backfill material is not sufficiently granular in nature to be self-draining during and after consolidation and foundation materials may be softened or otherwise damaged by applied water.

6.6.5 Procedure at Street Zone - The top 2-1/2' from finish street grade or ground surface, as the case may be, shall be compacted in horizontal layers not exceeding 6" in thickness, using approved hand pneumatic or mechanical type tampers to obtain a Standard Proctor Density of 95%. Flooding and jetting will not be permitted in this upper 2-1/2'. From existing street grade to 2-1/2' below street grade, the material for backfill may contain stones up to 2" in diameter, in quantity not exceeding 20% of the volume where said coarse materials are well distributed throughout the finer

material and the specified compaction can be obtained.

6.7 Compaction Tests

When required by the District Engineer, compaction tests will be taken by an approved testing laboratory at locations designated by the District Engineer. All expenses involved in these tests will be borne by the Developer/Owner. Results of the tests will be made available to the District Engineer immediately and copies of test results will be supplied to the District Engineer once per week. In all cases where the tests indicate compaction less than that required in these specifications, additional compaction and tests will be required until these specifications are met. Probationary acceptance of the lines by the District will be contingent upon satisfactory compaction results. No hydrostatic testing of the water main will be allowed until satisfactory compaction is obtained. Frequency of testing will be as follows:

- 1 test at every above ground appurtenance (i.e. valve box, manhole, hydrant, etc.)
- 1 test for every 1 foot of backfill for every 250 LF of mainline trench
- water service - eighty percent of the test shall be taken within 1 foot of edge of the curb pan in street and seventy percent of the test shall be taken below subgrade as to check for bridging. If water services are to be placed beneath existing curb and/or sidewalk, observation is required to report possible undermining. Undermining shall be immediately reported to the District Engineer.

6.8 Final Clean Up

After backfill and compaction has been completed, the right-of-way shall be dressed smooth and left in a neat and presentable condition as close to final grade or subgrade as possible and to the satisfaction of the District Engineer.

6.9 Safety Precautions

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operation rules, orders and regulations prescribed by the Occupational Safety and Health Administration Federal Register. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

6.10 Mechanical Joint Restraint

6.10.1 General – All mechanical joint restraints shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron conforming to ASTM A 536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-headed bolts conforming to AWWA C111 and C153.

6.10.2 Description – The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain.

6.10.3 Pressure – The mechanical joint restraint device for ductile iron pipe shall have a working pressure of at least 250 psi with a minimum safety factor of 2.

The mechanical joint restraint device for PVC shall have a working pressure of at least 150 psi with a minimum safety factor of 2:1.

6.10.4 Acceptable Manufacturer – The mechanical joint restraint devices shall be of the type listed below or equal, approved by Denver Water prior to bidding:

6.10.4.1 For Ductile Iron Pipe: See Materials Specifications

6.10.4.2 For PVC Pipe: See Materials Specifications

TABLE 1

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING MECHANICAL-JOINT PIPE

Size of * Pipe In.	Maximum Permissible Deflection per Length - Inches				Approx. Radius of Curve Produced by Succession of Joints - Feet			
	12-ft. Length	16-ft. Length	18-ft. Length	20-ft. Length	12-ft. Length	16-ft. Length	18-ft. Length	20-ft. Length
3	16	22	25		110	145	160	
4	16	22	25		110	145	160	
6	14	19	21		125	170	190	
8	11	14	16		165	220	250	
10	11	14	16		165	220	250	275
12	11	14	16	18	165	220	250	275
14	7	10	11	12	240	320	360	400
16	7	10	11	12	240	320	360	400
18	6	8	9	10	290	380	430	480
20	6	8	9	10	290	380	430	480
24	5	6	7	8	360	480	540	600
30	5	6	7	8	360	480	540	600
36	4	5.5	6	7	430	575	650	720
42	4	5	5.5	6	460	610	690	765
48	4	5	5.5	6	460	610	690	765

TABLE 2
 MAXIMUM PERMISSIBLE DEFLECTION IN LAYING
 PUSH-ON JOINT PIPE
 DUCTILE IRON OR CAST IRON

Size of* Pipe In.	Maximum Permissible Deflection per Length - Inches				Approx. Radius of Curve Produced by Succession of Joints - Feet			
	12-ft. Length	16-ft. Length	18-ft. Length	20-ft. Length	12-ft. Length	16-ft. Length	18-ft. Length	20-ft. Length
3	10	13.5	15	17	175	230	260	290
4	10	13.5	15	17	175	230	260	290
6	10	13.5	15	17	175	230	260	290
8	10	13.5	15	17	175	230	260	290
10	10	13.5	15	17	175	230	260	290
12	10	13.5	15	17	175	230	260	290
14	6	8	9	10	290	380	430	480
16	6	8	9	10	290	380	430	480
18	6	8	9	10	290	380	430	480
20	6	8	9	10	290	380	430	480
24	6	8	9	10	290	380	430	480
30	4	5	6	7	430	575	650	700
36	4	5	6	7	430	575	650	700
42	4	5	6	7	430	575	650	700
48	4	5	6	7	430	575	650	700

7. PROTECTION OF WATER LINES NEAR SANITARY SEWER FACILITIES

7.1 Crossings

Water mains shall be located a minimum of 10 feet horizontally from existing or proposed sanitary sewer lines (centerline distance). Where water mains cross house sewers or sanitary sewers, they shall be above sewers and laid to provide a vertical clear distance of at least 18" between the bottom of the water main and the top of the sewer. When a new water main crosses an existing sewer at a point less than 18" above the sewer, the District Engineer shall be notified and adjustments shall be made. Stability of the water and sewer lines at a point of crossing is critical and care must be taken to ensure proper welding and compaction of both water and sewer lines.

Where it is not feasible to install a water main above an existing or proposed sewer, e.g., to maintain minimum cover, the water main shall be laid to provide a vertical clear distance of at least 18" between the bottom of the sewer and the top of the water main. When the clear distance is less than 18", the District Engineer shall be notified. Refer to Sheet 27 of 75 of the Detail Sheet for description of the proper materials and construction techniques.

7.2 Manholes

No water pipe or main shall pass through or, come within 10' horizontally of, any part of a sewer or sewer manhole.

8. INSPECTION AND TESTS

8.1 Pipe Testing Prior to Construction

Before being used in any work under these specifications, and when directed by the District Engineer, pipe shall be subjected to and shall meet the requirements for testing pipe as established by the American Water Works Association in Specifications C-100, C-200, C-300, C-400 and C-900, depending on the type of pipe. These tests shall be made by the Contractor and shall be witnessed by a reputable testing laboratory. The Contractor shall deliver the pipe selected for testing to the place and at the time designated by the testing laboratory. Written test reports will be furnished to the District Engineer upon request.

The testing laboratory shall select at random for testing as herein specified up to 2% of the number of pipe in each size of pipe furnished, except that in no case shall less than five (5) specimens be tested.

The specimens selected for testing purposes shall be sound pipe having dimensions consistent with the referenced specifications. The lot or lots from which the test samples are taken shall be sufficient to fill the entire order for that size of pipe used in the work under the contract if they pass the tests, shall be so designated and marked.

All pipe shall be subject to inspection at the factory, trench or other point of delivery by the

District Engineer. The purpose of the inspection shall be to cull and reject any pipe that, independent of the physical tests herein specified, fails to conform to the requirements of the referenced specifications, or that may have been damaged during transportation and/or in subsequent handling.

The District Engineer reserves the right to reject any and all pipe sections that may contain visual imperfections or imperfections of any type that may be considered by the District Engineer to be detrimental to the operation and life of the pipe.

8.2 Pipeline Testing After Installation

8.2.1 Chlorination - All mains, extensions and private pipe shall be chlorinated in accordance with ANSI/AWWA C651-92, "Disinfecting Water Mains"

The chlorination of the finished pipelines shall be done prior to the hydrostatic testing.

8.2.1.1 Material - Chlorine tablets may be used for disinfection in twelve-inch (12") and smaller. For pipes having a larger diameter, a chlorine slurry is fed into the water filling the pipe. If chlorine tablets are used, they shall be attached to the inside top of the pipe with "Red" permatax just prior to the pipe installation. Hypochlorite may be used and shall conform to Federal specification O-C-114, Type II, Grade B.

8.2.1.2 Method - Flushing and sterilization of lines shall be accomplished in accordance with ANSI/AWWA C651-92. Chlorine dosage shall be at least 50mg per liter, and shall be retained in the line at least 24 hours, after which time the residual at the end of the line and at other representative points in the line shall be at least 10mg per liter. If the residual at the end of 24 hours is less than 10 parts per million, the entire operation shall be repeated.

All valves in the lines being sterilized shall be opened and closed several times during the contact period. After completion of sterilization, the system shall be flushed with clean water until the residual chlorine content is not greater than 1 part per million.

8.2.2 Hydrostatic Pressure Test

8.2.2.1 The hydrostatic test pressure for any type of pipe shall be 150 pounds per square inch based on the elevation of the lowest point in the line of section under test and carried to the elevation of the test gage. All sections of newly laid pipe, subsequent to backfilling, shall be subjected to the hydrostatic pressure test.

The duration of the hydrostatic pressure test shall be at least one (1) hour.

8.2.2.2 Air Removal Before Test - Before applying the specified test

pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points as the air can be expelled as the line is filling with water. After all the air has been expelled, the corporation cocks shall be closed and test pressure applied. Any cracked or defective pipe, fittings, valves or hydrants discovered in sequence of this pressure test shall be removed and replaced by the Contractor with sound materials in the manner provided under Section 6 of this specification, and the test shall be repeated until results satisfactory to the District Engineer are obtained.

8.2.2.3 Procedure - Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the District Engineer. The pump, pipe connection, gauges and all other necessary equipment and personnel to complete the test, shall be furnished by the Contractor and shall be approved by the District Engineer. All corporation cocks and taps to the main line and all connection piping and valves that may be required to make the test, whether or not specified or shown on the construction drawings, shall be installed by the Contractor. The District will require only the calibrated meters.

While the test pressure is maintained, the new pipe will be inspected and any leaks will be repaired. After all leakage has stopped, the pressure of 150 psi shall be maintained for one (1) hour. Allowable leakage for each section between line valves shall not exceed the following values:

Inside Diameter	Allowable Leakage per 1000 Ft/Pipe Gallons/Hr.	
	D.I.	PVC
4	0.37	0.33
6	0.55	0.50
8	0.74	0.66
12	1.10	1.00
16	1.47	----
20	1.84	----

Should the leakage rate be greater than the above set rates, the pipeline shall not be accepted. The pipeline shall be repaired, rechlorinated as described in 8.2.1 and retested.

The Contractor shall ensure that a satisfactory test is completed and shall employ all methods necessary to pass the test, including disconnection from existing watermains and use of a temporary plug, if necessary.

8.2.3 Clearwater Testing

Once a contractor has passed the initial chlorine test and hydrostatic test, it is imperative that the lines are thoroughly flushed. Hydrants/blow-offs should be opened completely starting at the one closest to the source water and progressing to the end of the line. Chlorine residual test will be performed at the time of the bacteriological test and the chlorine residual must be within 0.4mg/l of the source water. If the chlorine residual is higher than the source water, the line has not been adequately flushed and the test fails. If the chlorine residual is lower than the source water, the line may not have been adequately disinfected or flushed and the test fails. If the bacteriological test fails, re-chlorination of the water mains is required.

9. RESPONSIBILITY OF THE CONTRACTOR

The Contractor shall be responsible for notifying the District Engineer at least 48 hours prior to start of any construction. If work is suspended for any period of time after initial start-up, the Contractor must notify the District Engineer 48 hours prior to re-start.

At all points of connection of new water mains to existing mains, the Contractor will be responsible for excavating and verifying location of the existing lines, prior to installation of any new construction. If it is necessary to shut down any portions of the existing water system to make such connection, the Contractor will be responsible for notifying all District customers to be affected by water outage at least 48 hours prior to such outage. All existing water main valves shall be operated only by District Personnel. The duration of water outage to the existing District customers shall be minimized and if directed by the District Engineer, the Contractor shall provide temporary water supply to customers by means of tank trucks, temporary connections to charged facilities, etc.

The CONTRACTOR is responsible also for maintaining As-Recorded drawings complete with a Kinematic Gps Survey to include all distances between fittings, valves, locations of service tees, all changes, and all important notes. These as-builts and survey shall be transmitted to the District as AUTOCAD files on either floppy disk format or CD format.

The following shall be layered as follows:

1. Material, size, mains, valves (RHO) length and station.
2. Subdivision.
3. Street Address.
4. Parcels.
5. Type of line.
6. Fire hydrants, blow offs and air vacuums.
7. Meter locations.

8. Taps, service lines, size and material.
9. Pumps and PRV's.
10. Profile (top of pipe), length and station on water line (if non-standard).
11. Date installed and who installed.

These drawings will be turned over to the District Engineer and final acceptance of the line by the District will be contingent upon receipt of formal As-Recorded drawings in 24" x 36" size (scale 1" = 100') and submitted in reproducible and print form. Once the construction has been completed, all tests performed, and the mains deemed operational by the District, a walk-through inspection will be performed. Once all corrections to the system are made and approved, the District will issue a probationary acceptance of the system. Final Acceptance will be issued as outlined in the Rules and Regulations of the District.

The CONTRACTOR will be held responsible for the proper functioning of the lines for up to two (2) years from the date of probationary acceptance of the lines by the District. Any malfunction during this period of guarantee shall be remedied by the CONTRACTOR to the satisfaction of the District Engineer and at no expense to the District.

10. SERVICE LINES AND APPURTENANCES

10.1 GENERAL

Water is conveyed from mains to the plumbing of licensed premises by service lines and their appurtenances. In the context of these Standards, service lines include all pipe and fittings up to the point of entry into a residence as shown in the Standard Details, Section II. All water pipe beyond service pipe shall be controlled by the local plumbing codes.

All new or replacement service lines and appurtenant fittings installed in areas being supplied with potable water from the District shall conform to the following minimum standards which shall be binding regardless of the regulations of any other agency covering like installations.

The corporation stop, the meter, and that portion of the service pipe between the meter and the corporation stop shall all be of the same size.

10.2 OWNERSHIP AND MAINTENANCE

These water system specifications are intended to be supplemental and subordinate to the Operating Rules of the District and will be so construed in any conflicting situations.

10.2.1 Ownership - The service pipe and fittings through which a licensee receives water service from the facilities of the District shall be owned and installed at the expense of the licensee.

10.2.2 Owner Maintenance - The owner shall maintain all privately owned piping except as set forth under the referenced Operating Rules. This shall include the service pipe and all fittings and fixtures from the outlet side of the curb stop into and through the premises, except the water meter.

The curb stop service box and meter pit shall be kept conveniently accessible, not covered by any material, in good working order and properly capped and clean of debris. Any box or pit not conforming to these standards shall be cleaned, repaired or relocated by the owner of the premises within a reasonable time after notification by the District. Failure by the owner to comply may cause the District to do the necessary maintenance work and charge the cost thereof to the premises served.

10.2.3 District Maintenance – The District will provide limited maintenance and repair services to the segment of the service line located between the main and the outlet side of the curb stop as follows:

1. The repair of leaks on the service lines with curb stops which originate between the water main and the outlet side of the curb stop.
2. The repair of leaks on the service lines having an outside meter setting and no curb stop originating between the water main and the outlet side of the meter.
3. The repair of leaks on service lines not having curb stops or outside meter setting which originate between the main and the inlet side of the owners property line.
4. The repair of leaks on service lines connected to privately owned firelines as set forth above in addition to leaks originating on the fireline between the main and the inlet side of the fireline property line valve.

The District shall in no instance perform the repairs described above unless The District has actual notice of the leak and The District determines that sufficient manpower and equipment are available to make the repairs. Any service line items replaced or installed by The District while repairing a leak on a segment of the service line maintained by The District, shall become the property of the owner of the premises.

The customer shall retain total responsibility for repair of all leaks emanating from any segment of the service line or its appurtenances which are not within the boundaries described above. Any such leak shall be repaired by a licensed and bonded plumber, without delay, at the owners expense. In the event the leak is of serious nature or has not been repaired within a reasonable time, the service line may be shut off at either the curb stop or the main and service will be discontinued until

the service line has been repaired.

10.2.4 Frozen Service Pipes and Stub-In Connections The District will not be responsible for the thawing of frozen service pipe or appurtenances or repair to stub-in connections installed to permit street paving.

10.3 SERVICE LINES

10.3.1 General - Service lines shall be of the size which is adequate to supply the requirements of the property being served. The minimum size line shall be 3/4 inch. The only acceptable materials for a service line are seamless copper tube and ductile iron pipe. Service lines shall be of the same type material from beginning to end, unless the appropriate insulator is installed at the junctions of the dissimilar metals.

10.3.2 Layout and Location - Water service shall be located a minimum of ten feet (10') horizontally from the sewer service. Service lines shall be installed in a continuous line and shall enter the property a minimum distance of five feet (5') from the nearest lot corner.

The main to be tapped must extend a minimum distance of eight feet (8') along the front lot line of the property to be served and the service line connection and service must be a minimum distance of five feet (5') into the lot.

In the case of corner lots, the property may be served from the side lot line under the same regulations as above.

If service is requested for lots at the end of a cul-de-sac street, the main to be tapped must be not more than fifty feet (50') from any property line in the cul-de-sac. The service pipe shall be in a continuous straight line and shall enter the property a minimum distance of five feet (5') from the nearest lot corner.

No water taps will be made prior to hydrostatic testing and acceptance of the water mains by the District and all service line installations shall be in accordance with AWWA Standard C-800 and these specifications.

10.3.3 Depth - All service pipes shall be installed at least four and one-half feet (4-1/2') below the official street grade and in all other places at least four and one-half feet (4-1/2') below the surface of the ground. If, in the judgment of the District, the topography of the area indicates the advisability thereof, the service pipe shall be installed at lower depths.

If, after a service pipe has been installed, the grade of the surface of the ground is lowered, the property owner shall have a licensed and bonded plumber lower or relocate his service pipe so as to maintain a minimum cover of four and one-half feet (4-1/2').

10.3.4 Compaction - Prior to any backfilling, the service line and all of its appurtenances from the tap to the dwelling shall be inspected and approved by a representative of the District. Once approved for backfilling and compaction, the backfill material shall be carefully compacted as specified in Sections 6.6 and 6.7 of these specifications.

10.3.5 Separate Trenches - Service pipes may not be installed in trenches containing conduits that carry any substance other than potable water, and a service line shall be separated laterally from foreign conduits by a minimum of ten feet (10').

EXCEPTION: A SERVICE PIPE MAY BE PLACED IN THE SAME TRENCH WITH OTHER PIPE PROVIDED THE FOLLOWING CONDITIONS ARE MET:

1. The foreign pipe shall be ductile iron.
2. The bottom of the service pipe shall be at least twelve inches (12") above the top of the foreign pipe and shall be placed on a shelf excavated on one side of the common trench.

10.3.6 Combination Service Pipes - Combinations of domestic water services lines and fire services lines will require District Engineer's approval. Separate lines for fire service will be routed to buildings. Domestic taps to these lines are prohibited.

10.3.6.1 Connections to Mains for Fire Sprinkler Lines Sprinkler heads found in department stores, warehouses, etc., are supplied by a fire line. The fire line shall be sized by the local fire department and the persons responsible for the structure it protects. The **District** will not size fire lines.

The fire line shall be rodded cast iron or ductile iron pipe. The fire line shall have a valve two feet (2') from the property line on the street side of the property line as shown on Sheet 31 of the Standard Details.

10.3.7 Pipe Size - Service lines shall be of a size that is adequate to supply the requirements of the property being served. The minimum size allowable for a service line shall be three-quarter inch (3/4").

Adequate size for a service line shall be defined in terms of head loss as follows: The combined pressure drop in the service line and meter between the main and the building shall not exceed 25 p.s.i. at peak demand.

The requirements of the property being served shall be defined as peak demand, as calculated in the A.W.W.A. Manual of Water Supply Practices, or latest revision from the Uniform Plumbing Code's chapter on sizing domestic water service mains.

10.3.8 Type of Pipe - All service pipes supplying water from the District's system shall conform to one of the following specifications. Plastic pipe is not an acceptable

service pipe material.

1. Seamless Copper Tube of the type designated as "Type K" (soft) with insulator in the industry shall be used for service lines 3/4 inch through three inches (3"). Service lines larger than 3/4 inch must be silver soldered. No compression fittings are allowed.
2. Ductile Pipe conforming to the Materials Specifications may be used for all service lines larger than three inches (3").

10.3.9 Type of Service Line Material

1. Tapping saddles must be double-strap bronze type for D.I. pipe and full support, wide bearing type for PVC pipe.
2. Corporation stops must have AWWA taper CC threads.
3. See Materials Specifications- for approved curb stops.
4. See Materials Specifications- for approved curb stop boxes

10.3.10 Installation

1. No more than one (1) flared coupling on service line at pigtail.
2. Pigtail to house is to be one (1) continuous pipe.
3. Commercial service lines as well as commercial irrigation lines must have a reduced pressure backflow prevention device.
4. Lines will be pressure tested before backfilling trench.

10.4 PUMPS

Except where specifically authorized by the District, the installation of pumps designed to increase water pressure in service lines is prohibited.

10.5 CONNECTIONS FOR WATER

All connections shall be made in view of a representative of the District and by a licensed contractor acceptable to the District.

Connections will be made only after the release of the mains by the District following installation, submittal of the health release to the District, payment of appropriate fees, completion of the tap application papers, and installation of the service pipe from main to

curb stop by a bonded plumber. Any excavation necessary for tapping shall be completed prior to the arrival of the District representative.

Connections two inches (2") and smaller shall be made by a corporation stop, where applicable, of the same size as the service line and meter to be installed. Connections to the main for service pipes larger than two inches (2") shall be by a tee connection.

Connections to all ferrous mains shall be electrically insulated by means of a District approved insulating fitting. Care shall be taken to properly install corporation stops and to provide enough slack in service lines to protect against pullout problems.

Machined-over-all (MOA) polyvinyl chloride pipe may receive a corporation stop.

In tapping mains, it may be necessary to dig out bedding material and to cut or remove part of the polyethylene wrapping. After the taps are made, the polyethylene wrap shall be repaired or replaced by the plumber in such a manner as to protect both the pipe and corporation stop. The polyethylene wrap shall prevent contact between the pipe and corporation stop and backfill. Any bedding material removed during excavation shall be replaced in kind and compacted to the specifications contained herein.

10.6 TAPS AND SADDLES

The size of tap and the tapping method for a given type and size of water line shall be as follows:

SIZE OF PIPE	TYPE OF PIPE AND SIZE OF TAP							
	DUCTILE IRON				PVC			
	3/4"	1"	1-1/2"	2"	3/4"	1"	1-1/2"	2"
3"	NO	NO	NO	NO	NO	NO	NO	NO
4"	S	S	NO	NO	NO	NO	NO	NO
6"	DT	S	S	S	S	S	S	S
8"	DT	DT	S	S	S	S	S	S
12"	DT	DT	S	S	S	S	S	S
16"	DT	DT	S	S	S	S	S	S

"S" - Tapping saddle required - all saddles shall have the A.W.W.A. Taper on its threads.

"DT" - Direct tap permitted.

"NO" - No tap permitted with or without a saddle. A tee connection may be permitted if specifically authorized by the District Engineer.

PVC pipe must be de-pressurized prior to tapping.

10.7 METER

The District shall supply all meters and will install meters up to 2", any meters over 2" in size will be installed by the developer. All meters are installed for billing purposes and shall be under the control of the District and shall conform to these specifications. No meter shall be installed until the proposed installation has been approved, and the District has recorded meter number.

Meters used to record usage by the retail consumer are called service meters. Meters used by wholesale customers and which supply water to other service meters are known as master meters. Other temporary meters may exist in the system for the purpose of District testing.

The characteristics that are of special importance in meters are accuracy and sensitivity, durability, low pressure loss, cost at purchase and installation, and ease and low cost of maintenance.

All meter installation shall be inspected by a District representative upon completion of the installation. Installations that do not comply with these District Specifications shall be made to conform prior to installation of the meter by the District.

10.7.1 Size of Meter - Meters shall be of the same size as the corporation stop and that portion of the service pipe between the meter and the corporation stop. In no case shall a meter smaller than 3/4-inch be installed, except as a replacement for an existing smaller meter.

The District may allow the installation of a meter of a size smaller than the service pipe in cases where the full capacity of a previously used service pipe is not required provided that the service pipe is reduced to the size of the meter for a distance of not less than ten (10) times the larger pipe diameter on the inlet or supply side of the meter.

10.7.2 Type of Meter - The type of meter installed will be determined by the ENGINEER at the time of application based upon size, service requirements, location of meter and other conditions which may exist.

10.7.3 Magnetic Drive Displacement Type Water Meters - The displacement meters, known as rotating-disc or oscillating piston meters, are positive in action in that the pistons and discs displace or carry over a fixed quantity of water for each nutation or oscillation when operated under positive pressure. The magnetic drive displacement type water meter shall be either frost-proof case or split case.

Where there is a possibility of freezing, a frost-proof case or housing shall be used. The upper housing for cold climates includes all but the bottom plate. This is bolted on so that should the contents freeze, the bottom plate, or washers or bolts holding it on, will break before the meter as a whole is damaged. The bottom or the bolts can be replaced readily.

Meter sizes through 1 inch to be installed in outside pits or vaults shall conform to the Materials Specification, Section MS-18.

Meter sizes 5/8-inch through 1-inch to be installed inside a building and all 1 1/2-inch and 2-inch displacement type meters shall conform to the Materials Specifications, Section MS-18. Meter sizes 1 1/2-inch and larger shall be brass, two (2) hole, oval flange construction and shall not be slotted. Companion flanges shall be brass.

10.7.4 Compound Meters - Generally, compound meters consist of two meters, one to measure small flows and the other to measure large flows. The two meters are assembled either in one case or, especially for larger flows, in separate cases coupled together. Compound meters are so designed that the small meter operates during low flows and as flows begin to increase, the large meter takes over. When the large meter is in operation, the small meter may or may not be in operation.

Meters in sizes 3 inches through 6 inches, regardless of the type of installation, shall be compound type meters conforming to the Materials Specifications, Section MS-19.

10.7.5 Outside Meter Settings - Outside meters shall be installed in a horizontal position and housed in a concrete manhole or vault, and shall conform to the Standard Details.

10.7.6 Inside Meter Setting and Remote Readers - All inside meter settings shall be installed in a manner which will allow free access and adequate room for inspection and maintenance and will protect the meter from freezing. Meter sizes 3/4-inch and 1-inch installed inside of buildings shall be approximately 10-inches above the point at which the water service enters the building. Each service must include a stop and waste valve a pressure reducing valve and then the meter yolk. The meter may be no more than 18-inches away from the wall. Meter sizes 1 1/2-inch and 2-inch installed inside buildings shall comply with the Standard Details.

Inside meter settings will not be allowed in crawl spaces, closets or other places where free and easy access is not provided. Inside settings in partial basements shall comply with the Standard Details, Section II, and all other applicable requirements. Meter sizes 1 1/2-inch and 2-inch installed inside buildings shall be provided with a floor drain.

10.7.7 Meter Bypass Lines - Deleted 2/95

10.7.8 Meter Backflow Devices – Reduced pressure backflow devices are required on all commercial meter sets 3/4-inch to 6-inch

10.7.9 Valves For Use With Meters - Gate valves 3-inch and smaller to be used with copper service pipe shall be all bronze, with non-rising stems and solid wedge disc, manufactured in accordance with A.S.T.M. Specification B 62-76 and Federal Specification W.W.-V-54 Class A 125 psi W.S.P., 200 psi, W.O.G.

Valves for 1 1/2-inch and 2-inch meters shall be 1/4 turn ball valves as shown on the Standard Details.

Valves three inches (3") and larger for use with ductile iron service pipe shall be gate valves with cast iron bodies conforming to the Materials Specifications, Section MS-6, of the Parker Water & Sanitation District System Specifications, latest revision. All gate valves larger than three inches (3") shall be supported by adjustable steel valve supports.

10.7.10 Meter Couplings - All meters 1 1/2-inches and larger shall be installed with an adjustable coupling to allow removal of the meter without disturbing the pipe.

10.7.11 Meter Yokes (Line Setters) - A yoke is a metal pipe frame attached to the inlet and outlet sides of the meter providing support, and conveying water to the meter. See Materials Specifications-for approved meter yokes.

To assure safety, the water meter setting shall provide a continuous, electrically conductive, path around the water meter. The water meter setting must be grounded above and below the water meter. If a bonding jumper is required, it shall be made of copper with fittings suitable for the bonding jumper and the water pipe material. The meter setting installation shall be in compliance with the National Electric Code, Articles 100, 250-81, 250-94, 250-112 and 250-115(a).

10.7.12 Valve and Meter Supports - Meter supports shall be a solid concrete block as shown in the Standard Drawings.

Fabricated metal supports shall be used to support valves four-inches (4") and larger.

10.7.13 Residential Meter Pits and Covers - Meter pits shall consist of four twelve-inch (12") precast concrete rings or one twelve-inch (12") ring and one thirty-six inch (36") ring. The rings shall have a two-inch (2") wall thickness. Meter pit covers shall be airtight with a double cover. The meter pit cover shall have a cast iron, cap type, top lid. The inner lid shall be cast iron, aluminum or rubber. The body of the meter pit cover shall be cast iron or aluminum. Aluminum shall have a polymer coating such as an epoxy. All Meter pit lids must have 2" hole.

10.8 BACKFLOW AND BACKFLOW PREVENTION DEVICES

Backflow, which is the flow of water, or other liquid, or foreign materials into the distribution mains of the District's system from another source such as irrigation systems is strictly prohibited and shall be prevented by the installation of an appropriate, approved backflow prevention device, purchased and installed by the consumer at his own expense. A backflow prevention device will not be normally required for single family residences.

The type and complexity of the backflow prevention device shall be determined by the District in accordance with the "Manual of Cross-Connection Control for the Colorado Department of Health," and shall be based upon the degree of hazard caused to the public from contamination by toxic, or non-toxic substances.

A toxic substance is any solid, liquid, or gas which, when introduced into the water supply system, creates a danger to the health and well being of the consumer.

A non-toxic substance is any solid, liquid, or gas of a non-poisonous nature that is potable or edible, and that creates a moderate or minor hazard to the domestic water system. Examples are connections of food processing lines such as syrups, lard, beer, etc., or connections to steam and steam boilers where the steam does not come into contact with poisonous materials.

Devices vary as to function, and may be air gap type, reduced pressure backflow preventive type, pressure vacuum breaker, atmospheric vacuum breaker, or double check valve type. Backflow prevention devices are characterized by great care in construction details, the use of materials that will give the least possible wear or corrosion, and ready accessibility for inspection and cleaning. Each backflow prevention device has a separate degree of hazard protection. All commercial buildings have a minimum requirement of a pressure reducing assembly.

10.9 GENERAL METER NOTES

10.9.1 Location of the meter to be established by the District.

10.9.2 All settings must be inspected by a District Representative before backfilling.

10.9.3 If the street or ground is not to official grade at the time of installation of meter, the owner must raise or lower the meter vault when the final grade is established.

10.9.4 The service line through and on both sides of the meter pit must be of the same material.

10.9.5 No connection shall be made in the meter pit. Sprinkler connections must be made more than five feet (5') from the meter pit on the downstream side.

10.9.6 Gate Valves:

10.9.7.1 All gate valves under 3" for use with copper pipe shall be all bronze, with non-rising stems and solid wedge disc, manufactured in accordance with A.S.T.M Spec B 62 and Federal Spec. W.W.-V-54 Class A, 125 psi W.S.P., 200 psi W.O.G. or curb stops in accordance with AWWA C800 and the District Specifications. Flexible wedge type valves will be allowed under this section.

10.9.7.2 All gate valves 3" and larger for use with ductile iron shall conform to District Standards.

10.9.7 All Dresser (or approved equal) couplings shall have the pipe stop removed.

10.9.8 All valves 4" diameter and larger shall be supported by adjustable steel supports, and 1-1/2" diameter and larger meters shall be supported by concrete blocks with steel shims, if needed.

10.9.9 Manhole rings and covers:

10.9.10.1 24" manhole rings and covers shall be pattern, 24" lid Wt.=Approx, 165#, 24" Ring Wt.=Approx. 240#.

10.9.10.2 36" x 24" double manhole ring and cover. The 36" cover shall have an auxiliary 24" opening and cover. Approx Wt. of 36" cover = 250#. Approx. Wt. of 24" cover = 165#. Approx. Wt. of 36" ring = 280#.

10.9.11 Other meter settings: Settings of meters other than shown and detailed herein shall be considered as non-standard and shall require prior approval of proposed piping layout, meter setting and structural design of vault for each separate installation.

10.9.12 Backflow prevention devices shall be required in conformance with District Standard Approved devices shall be reduced pressure assembly type as manufactured by Watts or Febco or approved equal.

END OF SECTION