

CITY OF MARTINEZ

STANDARD SPECIFICATIONS FOR WATER LINE WORK

Engineering Division
Community Development Department
525 Henrietta Street
Martinez, CA 94553
(925) 372-3515

TABLE OF CONTENTS

STANDARD SPECIFICATIONS FOR WATER LINE WORK

- I. Water Pipe
 - A. General
 - B. PVC
 - C. Ductile Iron
 - D. Steel
 - E. Copper
- II. Fittings
- III. Installation
 - A. Trench
 - B. Over Excavtion
 - C. Trench Sheeting and Shoring
 - D. Pipe Installation
 - E. Pipe Bedding
 - F. Trench Backfill
 - G. Pavement Replacement
 - H. Measurement and Payment
- IV. Valves
 - A. Butterfly and Gate
 - B. Blowoff
 - C. Air and Vacuum Relief
- V. Pressure Tapping
- VI. Fire Hydrants
- VII. Service Connections
- VIII. Shutdowns to Existing Lines
- IX. Pressure and Leakage Testing
- X. Disinfection and Bacteriological Testing
- XI. Modifying Existing Water Line Facilities

WATER SPECIFICATIONS

This section covers materials and installation of water mains, fittings, and appurtenances and their incorporation into the City of Martinez Water System. All materials shall be manufactured and approved for potable water system.

I. WATER PIPE

Unless otherwise specified, water pipe shall be Polyvinyl Chloride (PVC), Ductile Iron (D.I.), steel (stl), or copper (Cu.) Water pipe must conform to the appropriate sections of the AWWA standards and to the sections specified herein. All water pipes and appurtenances shall be rated for a minimum working pressure of 150 pounds per square inch (psi).

A. General Classifications

Water pipe shall be classified as, 1) distribution pipe or main, 2) transmission pipe or main and 3) service line or lateral.

1. New distribution mains shall be of a size no smaller than 6-inch nominal inside diameter (I.D.) and shall be PVC or D.I. water pipe.
2. Transmission mains shall be of a size no smaller than 10-inch I.D. and shall be PVC, D.I., or steel water pipe. PVC pipe may be used if the size is to be 10" or 12". All pipe 16" in diameter or larger, shall be steel.
3. Service lines shall be of a size no smaller than 1-inch I.D. Service lines of sizes 1-inch and/or 2-inch shall be copper service tubing. Service lines of size 4-inch through 10-inch shall be PVC or D.I. water pipe.

B. Polyvinyl Chloride

Polyvinyl Chloride (PVC) pipe shall be pressure water pipe, pressure class 150 conforming to the requirements of AWWA C900. The maximum dimension ratio of diameter to wall thickness shall be 18. The outside diameter of PVC pipe shall conform to the OD dimensions of cast iron pipe.

A bare No. 12 copper tracer wire shall be placed along and taped to the top of all PVC water pipe installations. The tracer wire must be continuous between valve boxes and shall terminate in valve boxes unless otherwise approved. The tracer wire may be tested for continuity by the City prior to acceptance of the project. Any

replacement to achieve a continuous tracer wire will be at the expense of the Contractor.

1. Joints – Joining of PVC pipe shall be with elastomeric-gasketed bell ends or couplings.

The bell ends shall be integral thickened bell end or an integral sleeve-reinforced bell end. The bell end joints shall have a minimum wall thickness of the bell or sleeve-reinforced bell equal, at all points, to the DR (dimension ratio) requirements for the pipe. The minimum wall thickness in the ring groove and bell-entry sections shall equal or exceed the minimum wall thickness of the pipe barrel. All rubber rings shall be furnished by the pipe manufacturer.

PVC couplings shall be manufactured of the same material as the pipe and shall be furnished together with two (2) rubber rings. The couplings shall be designed and manufactured so as to ensure a watertight joint with the PVC pipe and shall conform to the requirements of Section 2 of AWWA C900-81. The couplings body and sockets shall have a wall thickness equal to the pipe barrel thickness with which the coupling is to be used.

All rubber rings (elastomeric gaskets) shall be manufactured to conform with the requirements of ASTM F477.

2. Fittings – All fittings for use with polyvinyl chloride pipe shall be cast iron of ductile iron, pressure rated at not less than 250 psi.

C. Ductile Iron Pipe

Ductile iron pipe shall conform to the requirements as specified in AWWA C151/A21.51. Pipes shall be lined and coated as specified herein.

1. The minimum thickness class for ductile iron pipe shall be as indicated in the following table. A higher thickness class may be required to meet design conditions as determined by calculations.

Nominal Size	ANSI Thickness Class
4 inch	53
6 inch	53
8 inch	53
10 inch	52
12 inch	52
14 inch	51
16 inch and larger	51

Note: The specified thickness class includes corrosion allowance and foundry tolerance.

2. Joints – Joints for ductile iron pipes shall be bell and spigot gasketed push-on joints in accordance with the AWWA C111. One gasket as furnished by the pipe manufacturer shall be furnished with each length of pipe.
3. Fittings – All fittings for use with ductile iron pipe shall be in accordance with AWWA C110. Fittings for pipe 12 inch and smaller shall have a pressure rating of 250 psi and 150 psi for 14 inches and larger.
4. Coating – Pipe and fittings shall have manufacturer’s standard bituminous or asphaltic coating in accordance with AWWA C151-8.
5. Lining – Pipe and fittings shall be cement lined (Double Thickness) in accordance with AWWA C104 only when specifically required or otherwise directed by the engineer
6. Corrosion protection – Pipe and fittings shall be protected by polyethylene tube or wrapping, in accordance with AWWA C105. All underground ductile iron surfaces, including coated surfaces, shall be enclosed within a minimum of 8-mil thick polyethylene encasement to form continuous and all-encompassing layer of polyethylene between all ductile iron surfaces and the surrounding earth or backfill material. All polyethylene shall be carefully secured with 10-mil thick tape.

A bonding strap may also be required across joints to provide electrical continuity only when specifically required or otherwise directed by the engineer.

D. Steel Pipe

Steel water pipe shall be approved only for transmission mains of size 16-inch through 30-inch and designed for a minimum working pressure of 150 pounds per square inch.

Steel pipe shall be of the size, type, and cylinder wall thickness or pressure class specified on the plans and shall conform to the requirements of AWWA C200, applicable provisions of Section 207-10 of the Standard Specifications for Public Works Construction, and as specified herein.

1. Joint – Pipe joints for steel pipe shall be bell and spigot ends with rubber gasket, unless otherwise specified. A bonding strap shall be installed across all joints to provide electrical continuity.
2. Lining and Coating – Steel pipe shall be cement-mortar lined and coated, in accordance with AWWA C205 or coal-tar enamel lined and coated in accordance with AWWA C203 or epoxy lined and coated in accordance with AWWA C210/213.

Cathodic protection for steel water pipe shall be achieved through sacrificial anodes or impressed current systems as approved by the engineer when specifically shown on the plans or otherwise directed by the Engineer.

E. Copper Pipe

Copper pipe and fittings shall conform to the requirement of the Uniform Plumbing Code, AWWA C800, and as specified herein. Water Service tubing shall be type K soft copper. The minimum size service line shall be 1-inch I.D.

Joints and fittings for 1-inch and 2-inch service. Fittings for copper water pipe shall be for threaded and/or flare connections. Compression or slip fittings shall not be used.

II. FITTINGS.

Fittings for water pipe shall be cast iron, ductile iron, steel, bronze, or brass in accordance with AWWA C110, AWWA C200, AWWA C800, the Uniform Plumbing Code and as specified herein.

All fittings for water pipe shall be manufactured specifically for use with the pipe being used and shall be installed in accordance with the manufacturer's recommendations and these special provisions. Any required rubber rings shall be furnished by the manufacturer of the fittings. All fittings shall be pressure rated at not less than 250 psi. Bolts, nuts and washers required to install fittings shall be stainless steel.

Fittings for water pipe of size 4-inch and larger shall have hub ends for "push-on" connections unless otherwise approved by the Engineer, except that any and all outlets for service connections or fire hydrant laterals shall be flanged.

All ductile iron, cast iron, or steel fittings shall be lined and coated. Interior lining shall be bituminous material or cement mortar in accordance with AWWA C110. Exterior coating shall be bituminous material in accordance with AWWA C110. Lining and coating for fittings to be connected to ductile iron or steel pipe shall be of the same material as the lining and coating of the pipe to be connected.

Unless otherwise approved, steel fittings shall only be used with steel water pipe.

Cast iron fittings shall be classified as "short body cast iron fittings" of material specified in AWWA C110 with metal thickness Class D. Ductile iron fittings shall be classified as "compact ductile iron fittings" of material specified in AWWA C153.

All pipes, fittings, and appurtenances shall be loaded for delivery, unloaded at site, and handled on site in such a manner as to avoid damage to pipes, fittings, and appurtenances.

III. WATER PIPE INSTALLATION

A. Trench Excavation

Reference is made to City of Martinez standard drawing for trench requirements. Excavation for water pipe shall be carried to a depth to allow three (3) inches below the outside surface of the coupling of the pipe when the invert of the pipe is set to designed grade. The bottom line of the trench shall be brought up to subgrade and thoroughly compacted so as to completely support the pipe throughout the entire length of the barrel. The subgrade for water pipe shall be understood to be the exterior bottom of the pipe.

B. Over Excavation

Measurement and Payment – Excavation in excess of that delineated in the plans and specifications deemed necessary and ordered in writing by the Engineer and not due in any part to carelessness or neglect by the Contractor, and refill shall be paid for as follows:

<u>Quantity</u>	<u>Depth</u>	<u>Payment</u>
Less than 5% of total design excavation.	Less than 2'	None
Less than 5% of total design excavation.	2' or greater	4% of the pipe installation price for each 10 th of a foot greater than 2' over depth per foot of excavation.
Excess of 5% of total design excavation, but less than 10%	No depth	2% of the pipe installation price for each 10 th of a foot over depth per foot of excavation.
Over 10% of total design excavation.	No depth limitation	Paid as extra work.

C. Trench Sheetting and Shoring.

Excavations and trenches shall be properly sheeted, shored, braced and/or sloped to support adjacent earth banks, structures, construction materials, and equipment and to provide safe work conditions. No trench, pit or other excavation shall remain open longer than is necessary to expeditiously carry out the work.

The Contractor shall furnish, put in place and maintain such timbering, lagging and bracing, etc. both in open cut and tunneling, as may be required to support the sides of the excavation and prevent any movements which could in any way injure any structure.

All excavations shall be supported in the manner set forth in the rules, orders and regulations prescribed by the Industrial Accident Commission of the State of California. All shoring of trenches that exceed five feet (5')

in depth shall comply with the Division of Industrial Safety (OSHA) standards.

The Contractor shall be responsible for any injury which may result to any person or persons, structure or structures, or to any interest whatsoever that is due directly or indirectly to the insufficiency of said timbering, lagging, and bracing, or to the replacing or removal of said timbering, lagging, or bracing.

Attention is directed to Section 7-1.02K(6)(B) "Excavation Safety, of the State Standard (Caltrans) Specifications and to the applicable provisions of the Labor Code of the State of California. (2010 Edition)

The contract price paid for trench sheeting and shoring shall be a lump sum and shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for furnishing, installing and removing sheeting and/or shoring for trench bracing. The lump sum contract price shall include any expenses incurred by the Contractor for design of the trench bracing and no additional compensation will be allowed therefor.

D. Pipe Installation.

Proper implements, tools and equipment shall be used to load, handle, deliver and install pipe. All water pipe, except residential service lines, shall be installed at a minimum depth from the top of pipe to finished grade of 3 feet, unless otherwise noted on the plans or approved by the Engineer. Water pipe shall not be installed in joint trench with any other utilities. When pipe-laying is not in progress, the open ends of installed pipe shall be closed to prevent entrance of trench water or other foreign material into the pipe. Excavation, bedding, and back fill shall be in accordance with the appropriate sections of the specifications and these special provisions.

All pipe shall be laid and maintained to the required lines and grades. Fittings, valves, and hydrants shall be at the required locations with joints centered and valve and hydrant stems plumb. No deviation shall be made from the required line or grade without the consent of the Engineer.

Assembly shall be as recommended by the manufacturer.

1. Pipe shall not be deflected horizontally or vertically more than ½ the limits recommended by the manufacturer.
2. Welded joints shall conform to AWWA standards.

3. Steel pipe joints with rubber-ring gaskets shall be protected with the same material as the pipe coating, placed in the field.
4. PVC pipe may be curved to change alignment, avoid obstruction or alter grade, but offsets per 20 foot pipe length will not exceed that specified herein. In making the pipe conform to the curve, the pipe should first be assembled in a straight line and then bent as they are lowered into the trench.
5. Steel water pipe shall be installed with bonding straps at all joints to ensure electrical continuity. Test stations and insulation kits shall be installed as noted on the plans.
6. Pipe Assembly – The following are important points to note and follow:
 - a. The gasket, groove and pipe spigot shall be free of all foreign materials. All foreign materials shall be removed prior to installation.
 - b. The gasket shall be installed such that the holes on the flat surface faces inside the coupling and the rounded edge faces the coupling entrance. The gasket must be evenly seated in the groove.
 - c. Lubricant shall be generously applied to the installed gasket, the coupling interior and the pipe spigot (from the taper end to the full insertion mark). Note that the lubricant should never be applied to the groove because of the potential for leakage.
 - d. Adequate stab shall be required in joining two pipe lengths. The spigot should be inserted into the coupling until it makes contact with the stop. The full insertion mark should be flush with the end of the coupling.
 - e. If field cuts are required, all cuts will be squared to the satisfaction of the Engineer. Field cut pipe shall have the burrs removed, ends beveled, and marked for proper insertion depth. A factory-finished beveled end shall be used as a guide in beveling. In addition, the full insertion mark will be copied onto the newly cut section to ensure proper stab and the spigot end will be copied onto the newly cut section to ensure proper stab and the spigot end will be beveled to an angle of approximately 15 degrees.

f. All fittings and valves shall be adequately blocked.

E. Pipe Bedding

Water pipe must be laid on stable bedding which evenly supports it. The trench bottom shall be smooth and free of rock larger than $\frac{3}{4}$ inches in diameter, and other deleterious or organic material. The weight of fittings, valves, and other appurtenances shall not be supported or carried by the pipe. Fittings, valves, and appurtenances shall be supported by concrete pad or drain rock, when in the judgment of the Engineer, soil conditions or pipe bedding does not provide proper support.

Pipe Bedding material shall be from three (3) inches below the pipe to six (6) inches above the top of pipe and for the full width of the trench. Bedding material for water pipes shall be Class 2 aggregate base as specified in Section 26 of the Caltrans Standard Specifications. The combined aggregate shall conform to the grading specified for $\frac{3}{4}$ - inch maximum aggregate. Bedding material shall be compacted by hand around PVC pipe and up to 6 inches above the pipe. Mechanical compaction will not be allowed until 6 inches of cover over the pipe is attained. The maximum compacted thickness of any one layer shall not exceed 0.5 foot and the relative compaction of each layer shall not be less than 90 to 95 percent as shown on the City standard trench detail.

Sand as a bedding material may only be used with specific approval of the Engineer. Sand bedding material shall have a minimum Sand Equivalent of 30 as determined by California Test Method. No. 217. The sand shall be densely graded and 100% shall pass No. 4 Sieve.

F. Trench Backfill.

Trench backfill shall be Class 2 aggregate base or select native material in accordance with conditions and details shown on the plans.

Class 2 aggregate base shall be $\frac{3}{4}$ - inch maximum grading as specified in Section 26 of Caltrans Standard Specifications and shall be compacted as shown on the plans.

Select backfill material shall be selected from the native excavation material and shall not include rocks or unbroken masses of soil larger than 4 inches in greatest dimension and shall only be used as shown on the plans or as directed by the engineer. See City standard drawing.

Backfill material shall be compacted by hand around PVC pipe and up to 6" above the pipe. Mechanical compaction will not be allowed until 6 inches of cover over the pipe is attained.

G. Trench Pavement Replacement.

Existing pavement shall be replaced in trenches in accordance with conditions and details shown on the plans. Prior to placing the permanent asphalt concrete pavement, the existing pavement shall be cut to neat lines parallel to the trench.

As shown on the plans and standard drawings asphalt concrete shall be placed in accordance with Section 39 of Caltrans Standard Specifications. Material shall be per State Specifications as follows:

Type "B", ½ inch maximum, medium grading.

The contract price paid for water pipe shall include full compensation for furnishing all labor, material, supervision, equipment and incidentals, and for doing all the work involved including prime coat, in furnishing and placing asphalt concrete complete in place as required by these special provisions and as directed by the Engineer.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all work involved in pavement replacement shall be included in the price paid for the various respective sizes of water pipe and no separate payment will be made therefor.

H. Measurement and Payment.

Measurement of the length of water pipe to be paid for shall be the actual slope length of the pipe in place, measured along the axis of the pipe and shall include fittings, elbows and couplings. Valves and tapping tee assemblies, which are bid items, are not to be included in pipe length measurement.

The contract bid price paid per linear foot for each of the various types of water pipe shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved.

Partial progress payment for pipe shall not exceed the following:
75% of the unit bid price until trenches have permanent paving;
60% of the unit bid price until leakage and bacterial tests have been approved.

The price bid for water pipe shall include full compensation for excavation, pipe bedding, trench backfill, compaction, A.C. paving, fittings, elbows, couplings, concrete thrust blocking, tie-down blocks,

disinfection leakage testing and all other items necessary for the installation of the pipe in conformance with the plans and specifications or as directed by the Engineer.

IV. WATER VALVES.

Valves shall be installed in conformance with the requirements specified herein and in accordance with the manufacturer's recommendations.

A. Butterfly and Gate Valves

All valve operation shall be left-hand (counterclockwise) opening.

All valves larger than 12-inch size, unless otherwise specified, shall be flanged butterfly valves. Butterfly valves shall be class 150B conforming to the requirements of AWWA C504, as modified or supplemented herein. Operator shall be manual of the type intended for buried service. Operation shall be by a wrench nut conforming to AWWA C500, Section 20. Butterfly valve disks shall seat in a position 90 degrees to the pipe axis, with a rotation of 90 degrees between full open and tight closed. Bolts used in the installation of all valves shall be stainless steel.

Butterfly valves shall be installed such that the operator will be on the side toward the nearest curb or edge of street.

Valves of 12-inch size and smaller and tapping valves, shall be gate valves. Gate valves shall be solid wedge with non-rising stems conforming to the requirements of AWWA C500 as supplemental herein. Stem seal shall be O-ring seal. Valves shall have smooth unobstructed waterway, free from sediment pockets. Gate valves shall be Mueller brand resilient seat gate valves or approved equal. Gate valves will normally be flange by ring tight unless otherwise required.

Valve extension shall be attached to the operating nut as necessary such that the operating nut is two (2) feet maximum below finished grade.

Valves manufactured for use with A.C. pipe shall not be used with PVC pipe. Gaskets shall be supplied by the manufacturer for installation with PVC pipe.

Bronze angle valves shall conform to the requirements of the Uniform Plumbing Code.

The bid price per unit valve shall include full compensation for furnishing and installing valve, valve boxes, riser pipes, concrete thrust block, backfill, trench paving and appurtenances complete in place.

B. Blowoff Valves

Blowoff valves and assembly shall be constructed in accordance with City standard water main details, manufacturer's recommendations and as directed by the Engineer.

Temporary blowoffs shall be provided as necessary to pressure test and disinfect water pipes. Temporary blowoff to be included in price for pipe.

The contract bid price paid per unit for permanent blowoff valves shall include full compensation for furnishing and installing valve, valve box, riser pipe, piping, fittings, concrete thrust block, and appurtenances, complete in place, including all excavation, backfill, and paving (temporary or permanent), which is incidental to the installation of the blowoff valve and assembly. Payment shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved.

C. Air and Vacuum Relief Valve

Air and vacuum relief valve assemblies shall be constructed in accordance with City standard water main details, manufacturer's recommendations and as directed by the Engineer.

All air valves shall be installed so as not to create a cross-connection and shall be vented as approved by the Engineer.

The contract bid price paid per unit for air and vacuum relief valve assembly unit shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved for installing valves, valve box, pipe, fittings, stops, service saddle, and appurtenances, complete in place, including all excavation, backfill and paving (temporary or permanent) which is incidental to the installation.

V. PRESSURE TAPPING

Connections or tie-ins to existing water mains shall be made by pressure tapping the existing main, as noted on the plans or approved by the Engineer.

A. Taps for Services

1. Service connections for 1-inch and 2-inch pipe shall be made with a drilling and tapping machine that will produce a pressure tight connection. The operator of the machine shall have a working knowledge of the machine's operation. Fittings for 2-inch and smaller service taps shall comply with Section II of these specifications for fittings for copper water pipe.
2. Service connections of size 4-inch and larger shall conform to the requirements for pressure tapping for main connections specified herein.
3. Full compensation for all labor, materials, equipment, and incidentals for pressure tapping for service line shall be included in the price paid for the installation, transfer, or replacement of water service.

B. Tap for Main Connections and Large Services

1. Pressure taps for main connections shall be of the size indicated on the plans by a drilling and tapping machine that will provide pressure tight connection and retrieve the coupon of the cut pipe. The bid item for tapping assembly shall consist of one tapping sleeve, tapping valve (s), valves box (es), and concrete thrust blocking. All materials shall be installed in accordance with the manufacturer's recommendation.
2. Tapping sleeves shall be a full circle compression type tapping tee mechanical joint designed for 150 pounds per square inch working pressure and shall be Mueller brand or approved equal.
3. Tapping valves shall be the rubber-ring type, unless otherwise noted, have "O"-ring seals, be lefthand (counterclockwise) opening, and shall be Mueller brand, American Darling brand, or approved equal.
4. All bolts for assembly shall be stainless steel unless otherwise approved by the Engineer.
5. Any damage to coating and lining on ductile iron or steel water pipe, fittings and valve shall be repaired in kind. Polyethylene Encasement for ductile iron pipe, fittings, and valves shall be required and shall conform to AWWA C105.

6. After the assembly of the tapping sleeve and prior to drilling of the tap, the tapping sleeve shall be subject to pressure and leakage testing.

The assembly tapping sleeve branch shall be sealed with a blind flange. The blind flange shall be fitted with a ¾-inch NPT test plug when the tapping sleeve has no test plug. A calibrated pressure gauge shall monitor the test pressure.

Pressurized air or water shall be introduced through a tee fitting attached to the test port. The branch tee shall connect to the pressure gauge. The test pressure shall be 100 psi for 30 minutes minimum duration without loss of pressure. When there is a drop in test pressure, the Contractor shall make the necessary corrections to make the tapping sleeve watertight. After the corrections, the tapping sleeve shall be retested.

During the assembly and testing of the tapping sleeve, the Contractor shall take the necessary precautions not to damage the existing main. Any damage to the existing main caused by the Contractor's operations shall be repaired at his expense.

7. The contract price paid per unit for tapping assemblies shall include full compensation for furnishing and installing the tapping sleeve and tapping valves, with valve boxes, riser pipes, and thrust blocks, complete in place as specified, including all trench excavation, trench backfill, and temporary and permanent pavement replacement which is incidental to the installation of the tapping assemblies.

VI. FIRE HYDRANTS

Fire hydrants shall be installed in conformance with the City of Martinez standard drawing for Hydrant Installations, the requirements specified herein and the standards established by the National Board of Fire Underwriters. The location of fire hydrants shall be determined by the Chief of the Contra Costa County Consolidated Fire District and approved by the Engineer.

Unless otherwise specified, fire hydrant body shall be the East Bay No. 5 Style manufactured by Long Beach, Clow, or an approved equal, with 1 – 2 ½” and 1 – 4 ½” port. Hydrant bodies shall be painted white.

- A. “Fire Hydrant Assembly shall consist of a fire hydrant body, (painted) bury, and riser, fittings, branch piping between the main and the fire hydrant, branch valve at the main, and all concrete, thrust block,

excavation, backfill, temporary and permanent pavement replacement and any other item directly associated with the installation of the fire hydrant.

- B. “Fire Hydrant Assembly – Existing Main” shall consist of all the above items plus the tapping assembly for the connection of the branch piping to the existing water main.
- C. The contract bid price for new fire hydrant assembly or transfer of existing fire hydrant shall include all compensation for installing the fire hydrant, assembly as defined above including labor, material, equipment and incidentals.

VII. WATER SERVICE CONNECTIONS

A. Service Saddle

Service saddle shall be used for 1-inch and 2-inch service taps. Service saddle shall be double strap, bronze, full circle with rubber gasket with corporation stop connection. Service saddles for iron pipe shall be full circle, double strap, malleable iron, with corporation stop connection outlet ½-inch larger than service size, with dielectric insulating bushing and rubber gasket. Service saddles on PVC pipe shall be specifically designed for PVC pipe.

1. Corporation stops shall be Mueller H1500 or approved equal.
2. Curbs stops shall be Mueller H10257 or Muller H15530 quarter bend coupling, copper to outside thread life, or approved equal.
3. Reducing bushing shall be brass.

B. 4-inch and Larger Service

Pipe and fittings for 4-inch and larger services shall conform to the requirement of Sections I and II above for PVC or Ductile Iron service line pipe.

C. Water Service Lines

Water service lines shall be of the size noted, and in the location specified, on the plans. Water service connections shall be in accordance with the City standard water main details, and the appropriate sections of these specifications.

1. New water services of sizes 1-inch and 2-inch shall be copper service tubing. Type K, soft copper pipe and fittings shall conform

to the requirements of the Uniform Plumbing Code and these special provisions.

2. New water services of sizes 4 inch through 10 inch shall be PVC or D.I. water pipe.
3. Service tap on a PVC water pipe shall be with a shell cutter specifically designed for PVC that will remove the chips and retain the coupon.
4. Existing copper services shall be transferred as specified. All transferred services shall be the same size as existing. Existing services which are of a material other than copper or of a size smaller than $\frac{3}{4}$ inch shall be replaced. Services placed in existing streets shall be bored from main to meter. Should it become necessary to extend a service or join two ends of a service, the union shall be made with threaded fittings – soldered joints will not be allowed.

Water service replacements shall be 1-inch minimum size copper pipe in accordance with the City Standard Specifications. All service lines shall be installed perpendicular to the main.

Water service transfers with existing copper services that are to be transferred shall be transferred with copper pipe of like size, $\frac{3}{4}$ -inch minimum size. Contract prices for transferring and replacing services will be measured and paid on the following basis:

- a. Short replacements shall consist of replacing services which are less than 25 feet in horizontal distance from the customer's meter to the new water line.
- b. Long replacements shall consist of replacing services which are less than 25 feet or longer in horizontal distance from the customer's meter to the new water line.
- c. Short transfers shall consist of transfers of service to the new water line where the new water main is between the old water line and the customer's meter, or if the new water line is less than 10 feet center to center from the old water line.
- d. Long transfers shall consist of transfers of services to the new water line where the old water line is between the new water line and the customer's meter and the old water line

and the new water line are more than 10 feet center to center apart.

The Contractor shall conduct his operations in such a way as to inconvenience the water customer as little as possible. The Contractor shall do as much of the work involved in transferring or replacing services as is possible before disconnecting the existing service connection. The Contractor shall not discontinue the existing service connection prior to obtaining the Engineer's approval.

All new services, unless otherwise authorized by the Engineer shall be a minimum distance of three (3) feet from the edge of any driveway or driveway approach. Water meters will not be set in driveways or driveway approaches. If after a meter is set, it is determined that a proposed driveway will encompass the meter, the meter shall be relocated at no cost to the City.

5. Measurement and Payment

The contract prices paid per unit for transferring services and replacing services shall include full compensation for furnishing all labor, material, tools, equipment and incidental, and doing all the work involved in transferring or replacing services, including all trench excavation, trench backfill, and temporary and permanent pavement replacement that is incidental to the transferring or replacing of the services.

The estimated quantity in the bid schedule for transferring and/or replacing services is approximate only for comparison of bids. No adjustment of the unit price will be made for any increase or decrease in the actual quantities required. The provisions of Section 3.2.2.1 of the Standard Specification for Public Works Construction regarding adjustments of payment shall not apply.

VIII. SHUTDOWN AND CONNECTIONS TO EXISTING WATER MAIN FACILITIES

Shutdowns or disruptions to any existing water lines shall be kept to a minimum. In general, shutdowns shall be made at times when there will be the least interference to users of water service. Connections to the existing water system shall be made only in the presence of and with the approval of the Engineer and as coordinated with the Water Superintendent. When a shutdown of the existing system is necessary to make the connection, it will be accomplished by City personnel. The operation of valves in the existing system by other than City personnel will not be permitted without specific authorization.

Waterline shutdowns shall only be permitted on Tuesday through Thursday except for emergency repairs. The contractor shall notify the Engineer not less than 72 hours in advance of the time being requested to start a shutdown in accordance with the deadline schedule shown below. This 72-hour notice shall not include weekends and holidays; however, it shall stipulate the expected length of the shutdown.

Upon approval, the City shall prepare and furnish notices of the water service shutdown to be distributed to all affected residents or other water service customers. City Manager approval is required for advance notification less than the deadline schedule. A map indicating the area that notices are to be distributed will also be prepared. Notices shall be distributed by the Contractor per deadline schedule. The contact phone number shall be Inspection Division (925-372-3515) for contractor projects and Maintenance Division (925-372-3580) for City maintenance or emergency work.

Such notices shall be distributed not less than 48 hours prior to the scheduled shutdown. There shall not be more than one scheduled shutdown within any 48 hour period and a shutdown shall not begin less than 36 hours after notices have been distributed.

All notices shall be placed as close as practical to the front door of each residence in a secure place, NOT IN MAILBOX.

Those delivering the notices shall indicate on a list, map or sketch the notices not delivered and provide this to issuing division. Specific addresses where notices were not delivered or placed in non-standard locations must be noted (for example, “dog in yard, not delivered” or “notice on backporch facing street.”)

DEADLINE SCHEDULE FOR WATER SHUTOFF NOTICES

<u>Shutoff Day</u>	<u>Distribute Notice</u>	<u>Request submitted</u>
Tuesday	Friday (4:00 p.m.) preceding work	Thursday (5:00 p.m.) preceding week
Wednesday	Monday (4:00 p.m.)	Friday (5:00 p.m.) preceding week
Thursday	Tuesday (4:00 p.m.)	Monday (5:00 p.m.)

Compensation for connections to the existing water mains (tie-ins) shall be included in the price paid for the water pipe and, shall include shutdowns of the system, notices to affected customers, coordination, liaison, exploratory excavations, and other necessary work to provide in the specifications, these special provisions and as directed by the Engineer.

IX. PRESSURE AND LEAKAGE TEST

After the pipe has been laid it shall be filled with water for a minimum of 24 hours and then subjected to a pressure and leakage test. The test pressure will be 150 pounds per square inch at the lowest elevation of the pipe system. Unless otherwise specified, the duration of the test shall be one (1) hour. The test shall be conducted after all backfill is complete within paved areas, but before the placement of the permanent pavement replacement. Outside the paved areas, or when in the opinion of the Engineer conditions require joint inspection during the test, the test shall be conducted after partial completion of backfill with all joints exposed. Concrete thrust blocks shall be at least 3 days old and concrete anchors shall be at least 7 days old before any test is made.

When difference in elevation between the low end and high end of the system to be tested is more than 25 feet, a separate test shall be given for each test section within 25 feet height increments.

All service taps and fire hydrants shall be installed before any pressure test is conducted.

A. Procedure

Each section of pipeline shall be slowly filled with water. The test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection, and all necessary apparatus including gages shall be furnished by the Contractor. The City will furnish gages for the actual test and operate all valves. The Contractor shall furnish all necessary assistance for conducting the tests. All cost for tests shall be at the Contractor's expense unless otherwise specified.

B. Allowable Leakage

1. **Joint leakage:** Any joint at which the accumulated leakage exceeds the rate per joint derived from Table I shall be rejected. Any defective elements shall be removed and replaced by the Contractor at his own expense. The test will then be repeated until satisfactory results are achieved.
2. **Overall Leakage:** Any pipe system for which the overall accumulated leakage exceeds the rate specified in Table I shall be rejected. Any defective elements shall be removed and replaced by the Contractor at his own expense. The test will then be repeated until satisfactory results are obtained.

TABLE I

a. Allowable leakage, ductile iron, steel pipe.

<u>Pipe Diameter (inches)</u>	<u>Allowable Leakage per 100 Joints of Pipe (gallons per hour)</u>
4	1.23
6	1.84
8	2.45
10	3.07
12	3.68
14	4.28
16	4.89
18	5.52
20	6.12
24	7.34
30	9.18
36	11.02

The data represents a leakage of approximately:

- (1) For 18-foot lengths of ductile iron pipe:
20 gallons per day per inch diameter.
- (2) For 32-foot lengths of steel pipe:
10 gallons per day per mile per inch diameter.

TABLE II

b. Allowable leakage polyvinyl chloride pipe

$$L = \frac{100 (D) (150)^{1/2}}{7400} = 0.1655D$$

L is the allowable leakage in gallons per hour for 100 joints of pipe.

D is the nominal diameter of the pipe in inches. 150 is the average test pressure in psi

X. DISINFECTION OF PIPES AND BACTERIOLOGICAL TESTING

A. Description

This section describes requirements for disinfection by chlorination of potable and recycled water mains, services, pipe appurtenances and connections.

1. Referenced Standards

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA B300 - Standard for Hypochlorites
AWWA B301 - Standard for Liquid Chlorine
AWWA C651 - Disinfecting Water Mains

2. Service Application

- a. All water mains and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.
- b. All new water mains and temporary high lines shall be disinfected prior to connection to the District's existing system.
- c. All components incorporated into a connection to the District's existing system shall be disinfected prior to installation.

3. Submittals

A written disinfection and dechlorination plan shall be submitted to the District Engineer for review and approval prior to starting disinfection operations.

4. Delivery, Storage and Handling

Chlorination and dechlorination shall be performed by competent individuals knowledgeable and experienced in the operation of the necessary application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of these materials shall be performed in accordance with Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.

5. Concurrent Disinfection and Hydrostatic Testing

The specified disinfection of the pipelines may be performed concurrently with the hydrostatic testing. In the event repairs are necessary, as indicated by the hydrostatic test, additional disinfection may be required by the Engineer in accordance with this specification.

6. Connection to Existing Mains

Prior to connection to existing mains, disinfection and bacteriological testing shall be performed in accordance with this specification, and hydrostatic testing shall be performed. District authorization for connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results.

B. Materials

1. Liquid Chlorine (Gas)

- a. Liquid chlorine contains 100-percent available chlorine and is packaged in steel containers in net weights of 68.1kg (150 lb.) or 907.2kg (1 ton).
- b. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled, high-concentration solution feed to the water. The chlorinators and injectors shall be the vacuum-operated type.

2. Sodium Hypochlorite (Liquid)

Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 0.95 L (1 Qt.) to 18.93 L (5 Gal). The solution contains approximately 10% to 15% available chlorine.

3. Tablet or Granular Hypochlorite

Tablet or granular hypochlorite shall not be used at any time.

C. Execution

1. General

- a. Disinfection of pipelines shall not proceed until all appurtenances and any necessary sample ports have been installed and the Engineer provides authorization.
- b. Every effort shall be made to keep the water main and its appurtenances clean and dry during the installation process.
- c. All piping, valves, fittings, and appurtenances which become contaminated during installation shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite disinfecting solution prior to installation.
- d. Water mains under construction that become flooded by storm water, runoff, or ground water shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire main shall be disinfected using a method approved by the Engineer.

2. Methods

Liquid Chlorine (Gas)

- a. Only vacuum-operated equipment shall be used. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be permitted. The equipment shall incorporate a backflow prevention device at the point of connection to the potable water source used to fill the line being tested.
- b. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.

- c. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. The chlorination contractor must also possess a Grade II Treatment Plant Operator Certification from the State of California if required by the Engineer.

Sodium Hypochlorite Solution (Liquid)

- a. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the District's existing system.
 - b. Sodium hypochlorite solution may be used for the initial disinfection of newly Installed water mains. The solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be installed and connected to the potable water supply.
 - c. Water trucks, pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.
 - d. Sodium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to insure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.
3. Procedure for Disinfecting Water Mains and Appurtenances
- a. The pipeline shall be filled at a rate not to exceed 1,135 liters per minute (300 GPM) or a velocity of 0.3m per second (1 foot per second), whichever is less.
 - b. Disinfection shall result in an initial total chlorine concentration of 25-mg/l. This concentration shall be evenly distributed throughout the system to be disinfected.
 - c. All valves shall be operated with the disinfection solution present in the pipeline. All appurtenances such as air-vacuum relief valves, blowoffs, hydrants, backflow prevention devices, and water service laterals shall be

flushed with the treated water a sufficient length of time to insure a chlorine concentration within the specified range in all components of each appurtenance. (Note the limitations for discharge of chlorinated water outlined below.)

- d. The Engineer will verify the presence of the disinfection solution throughout the system by sampling and testing for acceptable chlorine concentrations at the various appurtenances and/or at the test ports provided by the Contractor. Areas of the system found to be below the specified chlorine concentration level shall receive additional flushing as noted above and/or additional disinfection solution as necessary. (Note the limitations for discharge of chlorinated water outlined below.) Addition of disinfection solution after the initial charging of the line shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method.
- e. The chlorinated water shall be retained in the system for a minimum of 24 hours. The District Engineer will test the total chlorine residual. The system shall contain a total chlorine residual of not less than 80% of the initial total chlorine residual before the 24- hour soaking period began. If the total chlorine residual has decreased more than 20%, the system shall be soaked for an additional 24-hour period. If the total chlorine residual has not decreased after this additional 24-hour period, the system shall be flushed in accordance with the procedure detailed herein. If the total chlorine residual has decreased, the system shall be flushed in accordance with the procedure detailed herein, and shall be re-disinfected.
- f. Following a successful retention period as determined by the District Engineer, the chlorinated water shall be flushed from the system at its extremities and at each appurtenance, using potable water from a source designated by the District Engineer. The minimum water velocity during flushing shall be 0.9 meters per second (3 feet per second) or as directed by the Engineer. Flushing shall continue until the replacement water in the new system is equal in chlorine residual to the potable source of supply as verified by the District. (Note the limitations for discharge of chlorinated water outlined below.)

The District will perform bacteriological sampling and testing as specified herein.

4. Discharge of Chlorinated Water

- a. Indiscriminate onsite disposal or discharge to sewer systems, storm drains, drainage courses or surface waters of chlorinated water is prohibited.
- b. The environment to which the chlorinated water is to be discharged shall be examined by the Developer and the Engineer. Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of chlorinated water. Any indication that the discharge of chlorinated water may cause damage to the environment shall require the neutralizing of the chlorine residual by means of a reducing agent in accordance with AWWA C651 and the requirements of this specification.
- c. In locations where chlorine neutralization is required, the reducing agent shall be applied to the water as it exits the piping system. The Developer shall monitor the chlorine residual during the discharge operations. Total residual chlorine limits for the discharge of chlorinated water, from the testing of pipelines to surface waters are as follows:

Total Residual Chlorine Effluent Limitations

30-Day Average - 0.002 mg/l

Average Daily Maximum - 0.008 mg/l

Instantaneous Maximum - 0.02 mg/l

The various methods of dechlorination available can remove residual chlorine to concentrations below standard analytical methods of detection, 0.02 mg/l, which will assure compliance with the effluent limit. The Developer will perform all necessary tests to ensure that the total residual chlorine effluent limitations listed above are met. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

5. Bacteriological & Turbidity Testing

The District will perform bacteriological sampling and turbidity testing of all new system installations. The testing methodology employed by the District shall be as set forth in "Standard Methods for the Examination of Water and Waste Water" (current edition). Testing requirements are as set forth in the California Domestic Water Quality and Monitoring Regulations and commensurate

with current requirements for surface water testing. The District will analyze the samples for the presence of coliform bacteria, heterotrophic-type bacteria (heterotrophic plate count), and turbidity in nephelometric turbidity units (NTU). The evaluation criteria employed by the District for a passing test sample is as follows:

- a. Coliform bacteria: no positive sample, Heterotrophic plate count (HPC): 500 colony forming units/ml or less, and NTU less than 0.50.

6. Redisinfection

If the initial disinfection fails to produce satisfactory bacteriological test results, the pipeline system shall be re-flushed and re-sampled. If the second set of samples does not produce satisfactory results, the pipeline system shall be re-chlorinated, flushed, and re-sampled. The chlorination, flushing, and sampling procedure shall continue until satisfactory results are obtained. Redisinfection and retesting shall be at the Contractor's expense.

7. Disinfecting Tie-ins and Connections

Pipes, fittings, valves and all other components incorporated into connections with the District's existing system shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651 and as specified herein. Upon connection to the main, the line shall be flushed as directed by the District Engineer. Disinfection by this method is generally limited to assemblies of 6m (20') or less in length. Alternate methods such as "predisinfection" prior to installation in accordance with AWWA C651 may be required at the discretion of the District Engineer.

XI. MODIFYING EXISTING WATER LINE FACILITIES

A. Description

The work shall consist of removing, salvaging, adjusting, modifying, remodeling, abandoning, relaying, reconstructing, or resettling existing water line facilities as specified on the Plans or the Special Provisions.

B. Material

Pipe, fittings, concrete, trench excavation, trench backfill, and temporary and permanent pavement replacement shall conform to the appropriate sections of the Specifications.

C. Method

Facilities shall be removed or rearranged as specified. Removed facilities shall be salvaged as directed by the Engineer.

The installation of pipe, fittings, concrete, trench excavation, trench backfill, and temporary and permanent pavement replacement shall conform to the appropriate sections of the Specifications.

D. Interruption of Utility Service

No valve, switch or other control on the existing utility system shall be operated for any purpose by the Contractor. The City will operate all valves, switches, and other controls as necessary for the work.

E. Measurement and Payment

Quantities of pipe, fittings, concrete, trench excavation, trench backfill, and temporary and permanent pavement replacement will not normally be measured for this work.

When the contract includes separate items and prices for removing or rearranging existing facilities, the work will be paid for at the contract price for the item or work involved. The contract price shall include full compensation for doing all the work involved in completing the operations as specified.

When the contract does not include separate items for removing or rearranging existing facilities, full compensation for doing all the work involved in removing or rearranging existing facilities as specified will be considered as included in the prices paid for the various items of work, and no additional compensation will be allowed therefor.