SECTION 101

PIPE AND FITTINGS

101-1 GENERAL

101-1.01 Description. - This work consists of furnishing and installing water system pipe and fittings within City of San Jose, San Jose Municipal Water System service areas. Related work is specified in the following sections:

Section 19, "Earthwork"
Section 102, "Valves, Hydrants, and Appurtenances"
Section 103, "Miscellaneous Equipment"
Section 104, "Disinfecting and Pressure Testing"

Sewer and drainage work is specified in Section 1207 through 1501 of these City Standard Specifications.

101-1.02 Submittals. - Within 60 days after the date of the Notice to Proceed, the Contractor shall submit:

1. Working drawings showing the layout of all water lines showing pipe lengths, location and angles of bends, joint locations, and class of pipe.
2. Manufacturers' catalog data and details on the proposed pipe and fittings including joint details.
3. Manufacturers' installation instructions for pipe and fittings.

Test reports required by the various standards shall be submitted not later than the date the material is delivered to the job site.

101-1.03 Trenching. - Attention is directed to Section 5-1.02A, "Trench Excavation Safety Plans" of the General Conditions.

The City of San Jose does not issue a "Permit to perform Excavation or Trench Work," the Contractor shall secure a permit from the State, as required by Section 6500 of the State of California Labor Code.

The permit, together with a copy of approved trench excavation safety plan, shall be maintained on the job site at all times.

101-1.04 Certificates of Compliance. - The manufacturer shall establish the necessary quality control and inspection practice to assure compliance with these specifications. The manufacturer shall furnish a certificate of compliance, as specified in Section 6-1.07, "Certificates of Compliance," that all of the required tests have been made and the results thereof comply with the requirements of these specifications.

101-1.05 Existing Facilities. - Existing facilities shall be protected in accordance with the provisions in Section 7-1.11 "Preservation of Property" and in Section 8-1.10 "Utility and Non-Highway Facilities" of the General Provisions. Any damage done to utility lines shall be reported to the respective utility owner

by the Contractor, and any repair work required shall be done by such company's repair crew. All repair work will be approved by the Engineer prior to backfilling.

All sewer and utility lines that cross or lie along the trench shall be adequately supported during construction and such supports left in place. Care shall be exercised when backfilling around such lines to avoid any damage to them. Any pipeline or lateral, storm or sanitary, cut or damaged in any way shall be replaced in kind by the Contractor at no cost to the City. The damaged pipe shall be replaced between adjacent joints. Patching of damaged pipe will not be permitted.

101-1.06 Delivery, Storage, and Handling. - All materials shall be delivered and distributed at the site by the Contractor. Materials furnished by the City shall be picked up by the Contractor at points designated by the Engineer or at points indicated in the special provisions.

In distributing pipe and fittings at the site of work, each piece shall be unloaded with care opposite or near the place where it is to be laid in the trench. Under no circumstances shall such material be dropped, skidded or rolled against pipe or fittings already on the ground.

Should any part of coating or lining of the pipe or fitting be damaged, the repair shall be equal to, or better than the original coating or lining and the repair shall be done in accordance with the manufacturer's recommendation or in accordance with the applicable standards specified for the work.

101-2 MATERIALS

101-2.01 Ductile Iron Pipe. - Ductile iron pipe shall conform to the requirements of AWWA Standard C151. If the thickness class is not specified on the plans or in the special provisions, the appropriate class for a rated working pressure of 150 psi and for a depth of cover of 10 feet shall be furnished.

101-2.01A Coating and Lining. - Unless otherwise specified in the special provisions, ductile iron pipe shall receive an asphaltic coating as specified in AWWA Standard C151 and a cement-mortar lining as specified in AWWA Standard C104.

101-2.01B Joints. - Joints for ductile iron pipe shall be as specified in the special provisions and shall conform to the requirements of the following:

(1) Rubber gasket joints, push-on or mechanical: AWWA Standard C111
(2) Flanged joints: AWWA Standard C115

101-2.01C Fittings. - Fittings for ductile iron pipe shall be compatible with the pipe joint specified and shall conform to the requirements of AWWA Standard C110. If specified in the special provisions, compact fittings conforming to the requirements of AWWA Standard C153 shall be furnished, unless otherwise indicated on the plans.

101-2.02 Polyvinyl Chloride (PVC) Pipe. - Polyvinyl chloride pipe shall conform to the requirements of AWWA Standard C900 for nominal sizes 4 through 12 inches and AWWA Standard C905 for nominal sizes 14 inches and larger. Dimensions furnished shall be the cast-iron-pipe-equivalent outside diameters. If

the dimension ratio is not specified on the plans or in the special provisions, a pressure class or pressure rating of at least 150 psi at 73.4° F shall be furnished, unless otherwise indicated on the plans.

101-2.02A Joints. - Unless otherwise specified on the plans or in the special provisions, elastomeric gasket joints conforming to the referenced AWWA standards shall be furnished.

101-2.02B Fittings. - Fittings shall be specifically designed for use with dimension ratio and pressure rating of the pipe on which they are to be installed. Fittings shall be of the same material as the pipe and shall be marked as specified for couplings in AWWA Standard C900.

101-2.03 Concrete Pipe. - Concrete pipe shall be either reinforced concrete pressure pipe, steel cylinder type, or reinforced concrete pressure pipe, noncylinder type as specified on the plans or in the special provisions. Steel cylinder pipe shall conform to the requirements of AWWA Standard C300. Noncylinder pipe shall conform to AWWA Standard C302.

Pipe shall be designed for the design pressure and surge pressure specified on the plans or in the special provisions. If the design pressure is not specified, the pipe shall be designed for 150 psi design pressure and 200 psi surge pressure.

Where more than 1 design pressure and surge pressure are required for the project, the highest design-surge pressure combination shall be used throughout each reach of the pipeline. A reach is defined as a definite break in the pipeline such as a structure, open pit valve or other feature apparent at the ground surface. Identification marks of pipe sections shall be indicated on the layout drawings submitted as specified in Section 101-1.02, "Submittals."

101-2.03A Joints. - Joints shall be bell and spigot type employing steel joint rings and rubber gaskets in accordance with the appropriate AWWA standards specified herein.

101-2.03B Fittings. - Fittings shall be in accordance with the approved working drawings and in accordance with the requirements of appropriate AWWA standards specified herein.

101-2.04 Water Service Pipe. - Water service pipe shall be copper water tube . Copper water tube Type K, shall conform to the requirements of ASTM B 88 shall be annealed (Temper 0).

101-2.04A Joints and Fittings. - Joints and fittings shall be compression type. Unless otherwise shown on the plans or specified in the special provisions, component castings of service line fittings shall be composed of Copper Alloy UNS No. C83600, conforming to the requirements of ASTM B 62. The copper alloy consists of 85 percent copper and 5 percent each of tin, lead and zinc. The alloy is also known as red brass or composition bronze.

Threaded joints and fittings shall be made up with teflon tape applied to external threads.

101-2.05 Miscellaneous Materials. -

101-2.05A Anchor and Thrust Blocks. - Anchor and thrust blocks shall be Class A concrete conforming to Section 90, "Portland Cement Concrete" of these City Standard Specifications.

101-2.05B Bedding. - Bedding materials shall be as specified in Section 1301-2, "Materials", the plans and special provisions.

101-3 LAYING

101-3.01 General. - Pipelines shall be laid and maintained true to the line and grade as shown on the plans with fittings, valves and hydrants at the locations shown. If the grade and gradient are not shown on the plans, the pipe shall be laid for a minimum depth of cover from finished grade, of 36 inches for pipe 8 inches or less in diameter, and 42 inches for pipe greater than 8 inches in diameter. In new constructions areas where the proposed pavement section is 12 inches or greater, the pipe shall not be installed until the street base or subgrade has been prepared and accepted.

101-3.02 Excavation and Backfill. - Excavation and backfill shall conform to the applicable provision of Section 19, "Earthwork" of these City Standard Specifications and as specified herein.

The minimum clear width of trench measured at the horizontal diameter of the pipe shall be 18 inches or one foot greater than the outside diameter of the barrel of the pipe, whichever is greater. The maximum clear width of trench at the top of the pipe shall be not more than the outside diameter of the barrel of the pipe plus 2 feet and shall rise vertically to a height of at least 12 inches above the pipe.

101-3.03 Bedding. - Pipe shall be laid on a firm bedding foundation of the type and class as specified on the plans or in the special provisions, and shall have a constant bearing for its entire length except at joints. Bells or couplings shall not rest on solid original trench bottoms; bell or coupling holes shall be excavated. Laying of pipe on earth mounds or blocking will not be permitted.

101-3.03A Bedding Types. -

Type A. - Bedding material shall have a minimum thickness beneath the pipe of 4 inches, or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the trench to 12 inches above the top of the pipe.

Category of Pipe	Type of Bedding	Class of Material
Ductile Iron Pipe	A	I
Concrete Pipe		I
24" Diameter and Less	A	
25" Diameter and Greater	A	
Polyvinyl Chloride Pipe	A	I

101-3.03B Placing. - According to the class and type of bedding specified, the bedding material may be required to be placed and compacted in more than one lift. Class I material requires little or no compacting. Class III material, if specified for

use in the special provisions, requires hand or mechanical compaction. If no imported material is required for bedding the pipe, the initial backfill of the trench shall be native soil carefully shaded around the pipe and carefully compacted to the haunchline of the pipe. Precautions shall be taken to prevent movement of the pipe during placement of initial backfill.

101-3.04 Laying. - Regardless of the type of pipe shown on the plans or specified in the special provisions, the standard procedures for pipe laying specified herein shall apply.

Pipe will be carefully inspected by the Engineer in the field before and after laying. If any cause for rejection is discovered in the pipe, or its installation, the pipe shall be removed and any corrective action taken subject to the approval of the Engineer.

Laying of pipe and assembly of joints shall be in accordance with the printed instructions of the manufacturer and as specified herein.

At the time of laying pipe, the prepared trench shall be in a firm and dry condition. If trench is not in such condition, the contractor shall furnish and operate such pumps or other devices as may be necessary for removing water from trenches during the construction of pipeline system.

Necessary facilities shall be provided for lowering and properly placing the sections of pipe in the trench without damage. Each section of pipe, of the diameter as called for shall be laid true to the lines and grades as shown on the plans.

Pipe interiors shall be thoroughly cleaned of all foreign matter before being lowered into the trench. At all times when work is not in progress, ends of pipe and fittings shall be securely closed so that trench water, earth, or other substances cannot enter.

The pipe shall be laid on a firm bedding foundation of the type and class as indicated on the plans and shall have a constant bearing for its entire length. Wedging or blocking of pipe will not be permitted. Under no circumstances shall pipe be dropped into the trench.

Cutting of pipe for closures or other reasons shall be done in a neat and workmanlike manner by methods which will not damage the pipe or cement lining and will leave the cut end smooth and at right angles to the axis of the pipe.

Deflections from a straight line or grade resulting from horizontal or vertical curves or offsets shall not exceed the limits recommended by the manufacturer. If the required alignment requires deflections in excess of such limits for standard sections of pipe, special bends or a sufficient number of shorter lengths shall be provided to meet the offset limits.

When connections are to be made to any existing pipe or other appurtenances, the actual elevation or position shall be verified before laying any pipe. The engineer will inspect the existing pipe or appurtenance before connection is made. All adjustments in line or grade which may be necessary shall be made. The Contractor will be paid for any additional excavation required, below one foot of the designed grade, as extra work in accordance with the provisions of Section 4-1.03D, "Extra Work" of the General Conditions. The first one foot below designed grade will be considered as being included in the price paid for installing pipe.

101-3.05 Field Joints. -

101-3.05A Ductile Iron Pipe.

(1) **Push-on.** - The gasket and gasket seal inside the bell shall be wiped clean before the gasket is inserted. A thin film of soft vegetable soap compound shall be applied to the gasket and the outside of the plain-end of the pipe. Lubricant other than that furnished with the pipe shall not be used unless approved by the Engineer. The plain end of the pipe shall be forced completely into the bell socket to complete the joint.

(2) **Mechanical.** - The outside of the spigot and the inside of the pipe bell shall be thoroughly cleaned of foreign matter. The gland and gasket shall then be slipped on the spigot end of the pipe. The gasket shall be pressed evenly into the bell only after the spigot is seated in the bell.

The gland shall be brought up evenly by tightening alternately the nuts spaced 180 degrees apart.

(3) **Flanged.** - Flanged joints shall be firmly and fully bolted with machine bolts of proper size. Approved gaskets shall be used at all flanged joints.

101-3.05B Polyvinyl Chloride Pipe. - Polyvinyl chloride pipe shall be joined with elastomeric gaskets in the pipe bell end or in couplings. Spigot ends of pipe and gasket grooves shall be wiped clean. Gaskets shall be inserted in the grooves insuring that they are faced properly and completely seated. Apply lubricant to spigot end or machined end of pipe to the stop shoulder. Use only lubricant supplied with the pipe, unless otherwise approved by the engineer. Do not lubricate rubber rings. Assemble pipe using a bar and wood block or 'level' or 'friction' pullers. After assembly the ring position shall be checked with a feeler gage supplied by the pipe manufacturer.

101-3.05C Concrete Pipe. - Concrete pipe shall be joined with rubber gaskets.

Under ordinary laying conditions, the work shall be scheduled so that the bell end of the pipe faces in the direction of laying. Prior to placing the spigot into the bell of the pipe previously laid, the spigot groove, the gasket and the inside of the bell shall be thoroughly cleaned. Then the spigot groove, the gasket and the first 2 inches of the inside surface of the socket shall be lubricated with a compound supplied by the pipe manufacturer.

The gasket after lubrication shall be uniformly stretched when placing it in the spigot groove so that the gasket is distributed evenly around the circumference.

For pipe in which the inside joints are to be pointed, suitable spacers shall be placed against the inside shoulder of the socket to provide the proper space between abutting ends of the pipe.

After the joint is assembled, a thin metal feeler gage shall be inserted between the socket and the spigot and the position of the gasket checked around the complete circumference of the pipe. If the gasket is not in the proper position, the pipe shall be withdrawn, the gasket checked to see that it is not cut or damaged, the pipe relaid, and the gasket position again checked.

Where steel joint rings are used, a suitable cloth, plastic or paper band shall be placed around the outside of the pipe and centered over the joint to prevent dirt from entering the joint recess.

The joint band shall be bound to the pipe by the use of steel box strapping or by an equivalent method, and shall completely and snugly encase the outside joint

except for an opening near the top where grout is to be poured into the joint recess. Grout shall be poured and allowed to set before backfill is placed over the top of the pipe. The grout shall completely fill the outside annular space between the ends of the pipe and around the complete circumference. After the recess has been filled, the jointing band shall be replaced over the opening left for pouring and the mortar allowed to set. After the bedding and backfill have been compacted, the inside joint recess shall first be moistened, then filled with stiff mortar. The finished joint shall be smooth and flush with the adjacent pipe surfaces.

101-3.05D Water Service Pipe. - The various types of water service pipe shall be joined in accordance with the manufacturers' printed instructions, the applicable provisions of this section, and as approved by the Engineer.

Materials used in making joints shall be compatible with the pipe to be joined.

101-3.06 Anchor and Thrust Blocks. - Concrete anchors and thrust blocks shall be furnished and installed as shown on the plans and as specified herein.

Anchor blocks with harnesses, in accordance with the size and details as shown on the plans, shall be provided for vertical angle bend fittings to control upward thrust and for all gate valves 3 inches or larger. Anchor block or collar shall be provided for all reducer fittings 6" x 4" and larger.

Concrete thrust blocks shall be provided for all angle fittings, tees, crosses, and at the bowl of each hydrant. The dimensions of the thrust blocks shall be not less than as indicated on the plans and the block shall bear against firm natural ground. Great care shall be exercised on placement of thrust blocks so that the pipe and fitting joints are free and clear of concrete and are readily accessible for repair.

101-3.07 Connection to Existing Mains. - Connection to existing mains shall be made where indicated on the plans. The actual tap, if required, will be performed by Engineer approved personnel only. Normally, connections of new facilities to existing mains will be made at a "dead end" gate valve. In any case, the newly installed facilities shall be kept isolated from existing systems until the new facilities are bacteriologically acceptable, and pressure and leakage tests have been conducted.

Connections to existing valves prior to obtaining satisfactory leakage and pressure tests of the new facilities shall be at the Contractor's risk. The City will assume no responsibility for the water tightness of existing valves.

101-3.08 Installing Service Lines. - Generally, a water service line connection shall consist of a corporation stop with or without a saddle at the main, copper tubing, or other approved pipe, with coupling nuts, angle meter stop fitting and a meter box with base plate.

The water main shall be tapped at the service locations as shown on the plans. A minimum distance of 18 inches shall be maintained between taps. The tap shall be made at an angle of 45 degrees from top-dead-center of the main and on the same side as the direction of the service run. Under no circumstances shall service lines loop over the top of the water main, nor be laid in same trench with the sewer lateral.

The service line may be installed in open trench or placed through a hole produced by jacking or drilling. Services to adjacent lots may be laid in a common trench, provided 18 inches of clearance is maintained between services. The depth of service line, at the flow line of gutter, shall be not less than 24 inches. The end

of service line shall terminate 12 inches plus or minus one inch behind back of curb. The service line trench shall be backfilled in the same manner as specified in Section 19, "Earthwork" for backfilling pipeline trenches. After backfill has been completed, the meter box with base plate shall be set, with top of box at the same grade as top of curb.

101-3.09 Water Meters. - Meters will be set by City forces only after the following conditions are met: the curb and gutter are constructed, backfill and grading is completed between curb and sidewalk and the meter boxes installed. The Contractor shall notify the City of San Jose Municipal Water System in writing, 5 working days in advance of need for installation of water meters.

101-3.10 Backfill. - All trenches shall be backfilled with Type A bedding and Class I materials as specified in 1301-4.1.1, "Type of Bedding" and 1301-2.1.1, "Class I". The balance of the trench shall be backfilled with native material and mechanically compacted by approved methods. Care shall be exercised while compacting initial backfill so as not to dislodge the pipe, fittings, or appurtenances.

101-3.11 Surface Restoration. - All pavement, sidewalk, curbing, gutters, shrubbery, fences, sod or other disturbed surfaces or structures shall be restored or replaced to a condition equal to that before the work began. Such work shall be in accordance with the applicable provisions of these City Standard Specifications.

101-4 MEASUREMENT AND PAYMENT

101-4.01 Measurement. - The work to be performed under this Section will be listed in the contract item by pipe size, type, thickness, or whatever information is necessary for identification.

The length of pipe mains to be paid for will be the horizontal length measured from centerline of structure to centerline of structure or terminus. Pipe placed in excess of the length designated will not be paid for. Laterals will be measured and paid for by the horizontal measurement from inside face of structure to inside face of structure or terminus. Stub outs will be measured per linear foot and paid for by length designated on the plans or the length actually installed if ordered by the Engineer.

Measurement will be made continuously through bends, wyes, tees, and other special sections.

101-4.02 Payment. - Pipe, measured as specified above, will be paid for at the contract unit price, per linear foot for the various types, sizes, and classes of pipe installed.

The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing various sizes and classes of pipe including all bends, wyes, tees, and other special sections, connecting new pipe to existing facilities, complete in place, restoration of pavement, testing, flushing and cleaning, disinfecting, all as shown on the plans, as specified in these specifications and as directed by the Engineer.

SECTION 102

VALVES, HYDRANTS, AND APPURTENANCES

102-1 GENERAL

102-1.01 Description. - This work consists of furnishing and installing valves, hydrants, and appurtenances. Related work is specified in the following sections:

Section 19, "Earthwork"
Section 101, "Pipe and Fittings"
Section 103, "Miscellaneous Equipment"
Section 104, "Disinfecting and Pressure Testing"

102-1.02 Submittals. - Within 60 days after the date of Notice to Proceed, the Contractor shall submit:

1. Working drawings and manufacturer's data showing unit assembly, operators, component parts, dimensions, and net weight.
2. Details of end connections.
3. Manufacturer's installation, and operation and maintenance instructions.
4. Test records.

102-1.03 Certificates of Compliance. - The manufacturer shall establish the necessary quality control and inspection practice to assure compliance with these specifications. The manufacturer shall furnish a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the General Conditions, that all the required tests have been made and the results comply with the requirements of these specifications.

102-1.04 Interruption of Service. - Service in existing mains can be interrupted only upon authorization of the Engineer who will specify time and duration of the outage. The Contractor shall notify all affected users in writing at least 24 hours in advance of service interruption, using printed forms provided by the Engineer. The Contractor shall also request the Engineer to notify the Municipal Water System personnel at least 48 hours in advance of scheduled valve closing for service interruption. Manipulation of existing valves shall only be done by or under the direction of Municipal Water System personnel.

102-1.05 Marking. - Valves and hydrants shall be marked in accordance with the requirements of the appropriate specified standard.

102-2 VALVES

102-2.01 Butterfly Valves. - Butterfly valves shall conform to the requirements of AWWA Standard C504, as specified herein and in the special provisions. The following will be specified in the special provisions or on the

plans: Class, if no class is specified, Class 150B valves shall be furnished; valve ends, operator requirements, and other special requirements.

102-2.01A Body. - Valve body shall be of ASTM A 126 Class B cast or ductile iron.

Valve designs utilizing continuous rubber lining on the internal body surfaces and extending over the flanges or a disk which sits at an angle to the axis of the pipe shall not be furnished.

102-2.01B Seats. - Seats for potable water service shall be of molded new natural rubber or approved synthetic rubber.

Seat shall be mounted on disc or in body.

Seats mounted on disc shall be mechanically fastened to the disc with stainless steel hex head screws. Rubber seat shall be reinforced with stainless steel retaining ring. Seats vulcanized or bonded to the disc are not acceptable.

Seats mounted on body shall be clamped or mechanically secured with stainless steel fasteners or bonded to the body by an approved process.

102-2.01C Mating Surfaces. - Mating surfaces for valves with seat on disc shall be Type 304 or 316 stainless steel. Mating surface shall be mechanically retained in body and sealed with an O-ring.

Mating surfaces for valves with the seat in the body shall be Type 304 or 316 stainless steel or plasma applied nickel-chromium material containing 80 percent nickel, 20 percent chrome.

Plated or sprayed-on mating surface material is not acceptable.

102-2.01D Discs. - If seat is on the disc, the disc shall be of ASTM A 126 Class B cast or ductile iron. If seat is in the body, the disc shall be of ASTM A 126 Class B cast iron, ductile iron, or Type 304 or 316 stainless steel. Stainless steel edge on cast or ductile-iron discs shall be secured with stainless steel threaded fasteners, heat shrunk on disc, a welded-on overlay, or a plasma applied nickel-chrome material.

102-2.01E Shafts. - Shaft shall be of Type 304 or 316 stainless steel. Shaft shall be either one piece extending completely through disc or stub shafts inserted into valve disc stubs.

Shaft seal shall be of the split-V type or O-ring type. Seal shall be replaceable without disassembly of valve.

102-2.01F Actuators. - Each valve shall have a position indicator.

Actuators shall be capable of valve operation at rated pressure with a pull not exceeding 80 pounds on actuator. Operator shall be self-locking.

102-2.01G Dimensions and Tolerances. - Butterfly valves and parts shall conform to the dimensions and tolerances as specified in AWWA Standard C504 and when assembled, valves shall be well fitted and smooth operating.

102-2.01H Quality Requirements. - Butterfly valve parts shall be tested for the physical and chemical properties as specified in AWWA Standard C504. After manufacture, each butterfly valve shall be subjected to operation and hydrostatic tests as required by AWWA Standard C504.

102-2.02 Resilient Seated Gate Valves. - Gate valves shall conform to the requirements of AWWA Standard C509, as specified herein and in the special provisions. The following will be specified in the special provisions or on the plans: type of valve ends, and type of stem seal.

The intended position of the valves is approximately level with the stem positioned vertical. The operating wrench nut shall be 2 inches square with direction of opening, counterclockwise.

The valve main connection fittings shall be compatible with the type of pipe to which the valve will be attached.

102-2.02A Disc Wedging Mechanism, Valves 10-Inch and Larger. - For gate valves 10 inches and larger, the operating mechanisms of the parallel bronze discs shall be designed so that the seating pressure is applied to the discs equally at 4 separate contact points near the outer edge of each disc. The discs and wedging mechanism shall be held together as a unit. The side spreaders of the wedging mechanism shall be self adjusting to act as equalizers between the top equally to the 4 contact points. In closing the valve, the discs shall move freely to a position opposite the port openings of the body before engaging the side spreaders against wedges cast integrally with each disc. In opening the valve, the first movement of the stem shall lift the top wedge nut directly away from the side spreaders to relieve the wedging pressure before the discs can begin to rise.

102-2.02B Disc Wedging Mechanism, Valves 8-Inch and Smaller. - The disc wedging mechanism for gate valves 8 inches and smaller shall be as indicated above or may be of the bottom wedging type with 2 point floating wedge contacts.

102-2.02C Dimensions and Tolerances. - Gate valve parts shall conform to the dimensions and tolerances as specified in AWWA Standard C500 and when assembled, valves shall be well fitted and smooth operating.

102-2.02D Quality Requirements. - Gate valve parts shall conform to and shall be tested for the physical and chemical properties as specified in AWWA Standard C500. After manufacture, each gate valve shall be subjected to operation and hydrostatic tests as required by AWWA Standard C500.

102-2.03 Air Relief Valves. - Air relief valves shall have one-inch inlet and outlet connections and 3/8-inch orifice. Air relief valves shall be constructed of the following materials: body and cover, ASTM A48 Class 30 cast iron; float and leverage mechanism, ASTM A 240 or A 276 stainless steel. The orifice and seat shall be stainless steel against Buna-N or Viton. All other valve internals shall be stainless steel or bronze.

102-2.04 Combination Air Relief and Vacuum Valves. - Combination air relief and vacuum valves with flanged inlet and outlet connections as shown on the plans. High pressure air release valve shall be a one-inch inlet and outlet and 3/8-inch orifice. Vacuum valve shall be constructed of the following materials: body and cover, ASTM A48 Class 30 cast iron; float, ASTM A240 stainless steel; seat, Buna-N. The air relief valve shall be constructed as specified in Section 102-2.03, above.

102-2.05 Tapping Sleeves and Valves. - Tapping sleeves shall be split sleeve, fabricated of steel and fusion epoxy coated. Tapping valves shall conform to the requirements for gate valves as specified in Section 102-2.02.

102-3 HYDRANTS

102-3.01 Fire Hydrants. - Fire hydrants shall be obtained from the City of San Jose Fire Department. The Contractor shall pay the City Department of Public Works for each hydrant at the price current as of the date of the Notice to Contractors. Each bidder shall obtain the current price from the Department prior to submitting the bid, if fire hydrants are part of the work under this contract.

102-4 INSTALLATION

102-4.01 General. - All debris, dirt, and other foreign matter shall be cleaned from pipes and mating surfaces before valves and hydrants are installed.

Valves and hydrants shall be erected and supported in their proper positions such that they are free from distortion until completely installed and blocked. All debris and other foreign matter shall be cleared from openings, seats and other parts. Operating mechanisms shall be tested and adjusted for proper function. Bolts and nuts shall be checked and tightened, if necessary.

Items shall be set plumb and in line and shall be shimmed and grouted in place as required to complete the work.

Valves shall have extension stems such that the length of the operating wrench will not exceed 6 feet.

102-4.02 Valves. - Valves shall be installed at the locations shown on the plans in accordance with manufacturer's recommended practice. Valves shall be set in a vertical position. Temporary blocking will be allowed to support valve or fitting until permanent anchor or thrust block is installed.

102-4.02A Valve Boxes. - A valve box shall be provided for valves as indicated on the plans. Valve boxes shall be firmly supported and shall be centered and plumb over the wrench nut of the gate valve, the box cover shall be flush with the surface of the finished pavement.

102-4.03 Fire Hydrants. - Fire hydrants shall be installed at the locations as shown on the plans. When placed behind the curb, the hydrant barrel shall be set 6 feet behind face of curb with hose nozzles parallel with the curb, and pumper nozzle facing the curb. The nozzles of hydrants set at locations without curbs shall be oriented as directed by the Engineer. Each hydrant shall stand plumb with the flange of the bury located 2-1/2 inches to 4 inches above the top of curb.

Each hydrant shall be connected to the main with a 6 inch ductile-iron branch controlled by an independent 6 inch gate valve. A thrust block of 3 square feet of bearing minimum shall be provided at the tee fitting (bowl) of each hydrant.

102-4.04 Air Relief Valves. - Air relief valves shall be installed in accordance with the details shown on the plans. In addition to the locations shown on the plans, air relief valves shall be installed at such locations, as determined by the Engineer, whenever any high point occurs in the line caused by a vertical change in grade of the main.

102-5 MEASUREMENT AND PAYMENT

102-5.01 Measurement. - Valves and hydrants will be measured as units for each type and size from actual count as installed in the work.

102-5.02 Payment. - Valves and hydrants, measured as specified above, will be paid for at the contract unit price each.

The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing the valves and hydrants, including valve vaults and boxes, thrust and anchor blocks, connecting to pipes, testing, flushing, cleaning, disinfecting, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 103

MISCELLANEOUS EQUIPMENT

103-1 GENERAL

103-1.01 Description. - This work consists of furnishing and installing valve vaults, valve boxes, and meter boxes. Related work is specified in the following sections:

Section 19, "Earthwork"
Section 101, "Pipe and Fittings"
Section 102, "Valves, Hydrants, and Appurtenances"

103-1.02 Submittals. - Within 30 days after the date of Notice to Proceed, the Contractor shall submit:

Working drawings showing dimensions and details of precast units.

2. Manufacturers' catalog data on the proposed precast units.

103-1.03 Quality. - Valve and meter boxes and vaults shall be manufactured in conformance to the requirements of these specifications and shall be tested for the strength requirements as specified in these and referenced specifications.

103-1.04 Certificates of Compliance. - The manufacturer shall establish the necessary quality control and inspection practice to assure compliance with these specifications. The manufacturer shall furnish a certificate of compliance, as specified in Section 6-1.07, "Certificates of Compliance" of the General Conditions, that all of the required tests have been made and the results thereof comply with the requirements of these specifications.

103-1.05 Classification. - Meter boxes are classified by nominal size according to size of meter to be contained therein. The nominal size of the meter boxes to be furnished and installed shall be as shown on the plans and shall conform to actual dimensions as shown in the standard details. Valve boxes are not classified as such as only one size, as shown on the plans, shall be used in the work for the Municipal Water System.

103-2 MATERIALS AND FABRICATION

103-2.01 Concrete. - Concrete shall be in accordance with the requirements of Section 90, "Portland Cement Concrete." Class A concrete shall be used for valve and meter boxes. Where precast units are to be used for valves and meter boxes, concrete shall have compressive strength of 4,000 psi.

103-2.02 Reinforcement. - Concrete reinforcement shall conform to Section 52, "Reinforcement." Grade 40 or 60 bars shall be used in valve and meter boxes, and Grade 60 bars shall be used in vaults.

103-2.03 Metals. - Metals shall conform to Section 75, "Miscellaneous Metal." Covers, lid seats, and ring seats shall be gray iron castings Class 30 B. Steel floor plate shall be galvanized steel conforming to the requirements of ASTM A 525, G 90 or heavier zinc coating.

103-2.04 Fabrication. - Meter and valve boxes shall conform to the dimensions as shown in the standard details.

Meter box covers of the same nominal size shall be interchangeable yet close fitting but easily removable. Meter boxes shall have nonsettling outside shoulders. Each meter box shall have a base plate or slab conforming to outside dimensions of the meter box. Reading lids shall be machined for close fit and ease of operation.

Vaults shall be sectionalized and shall conform to the dimensions as shown in the standard details.

Valve box ring seats and covers shall have machined seating surfaces and shall be completely "rattleproof." Extensions shall fit inside of the valve box and may be of any rigid thin wall pipe material.

103-2.05 Markings. - Covers for water meter boxes and vaults shall be marked with the words "WATER METER" and valve box covers shall be marked with the work "WATER."

103-3 INSTALLATION

103-3.01 Earthwork. - Excavation and backfill shall conform to the requirements for structure excavation and backfill in Section 19, "Earthwork."

103-3.02 Setting. - Unless otherwise shown on the plans or specified in the special provisions, a valve box or vault shall be provided for every valve as indicated on the plans. Valve boxes shall be firmly supported and shall be centered and plumb over the wrench nut of the gate valve, the box cover shall be flush with the surface of the finished pavement. Boxes and vaults shall be accurately set to grade of the surrounding surface or at such elevation as shown on the plans or as determined by the Engineer, and the box or vault shall rest on a firm foundation.

A meter box shall be provided for each meter as shown on the plans.

103-4 MEASUREMENT AND PAYMENT

103-4.01 Measurement and Payment. - Full compensation for furnishing and installing valve vaults, valve boxes, and meter boxes shall be considered as included in the contract unit price for the applicable valve or meter and no separate payment will be made.

SECTION 104

DISINFECTING AND PRESSURE TESTING

104-1 GENERAL

104-1.01 Description. - This work consists of disinfecting and pressure testing water systems. All incidental materials and equipment not mentioned in these specifications or the special provisions, or shown on the plans which may be necessary to complete testing and disinfecting, shall be furnished and installed as required to complete the work. The City will furnish all water required, and the Contractor shall provide for safe and adequate disposal of all water upon completion of testing and disinfecting.

104-2 DISINFECTING

104-2.01 Description. - This work consists of disinfecting water system initial installations and after repair. The work shall be accomplished in accordance with the provisions of AWWA Standard C651, as specified herein, the special provisions, and as directed by the Engineer.

104-2.02 Submittals. - At least 14 days prior to the start of disinfecting, a description of the method and procedure to be used shall be submitted.

104-2.03 Certification. -

104-2.03A Quality Requirements. - Liquid Chlorine and hypochlorites to be used as disinfectants shall conform to the physical requirements and shall be tested in accordance with the provisions of AWWA Standard B301 or B300.

104-2.03B Packing and Marking. - Liquid Chlorine and hypochlorites shall be sampled, inspected, packed and shipped in containers as specified in reference AWWA Standards.

104-2.03C Certificate of Compliance. - The manufacturer or producer of Liquid Chlorine or hypochlorites shall establish the necessary quality control and inspection practice to assure compliance with these specifications. The manufacturer or producer shall furnish a Certificate of Compliance, as specified in Section 6-1.07, "Certificates of Compliance" that all of the required tests have been made and the results thereof comply with the requirements of these specifications.

104-2.04 Materials. -

104-2.04A Classification. - Disinfectants of the chemical element chlorine are classified as to the form of the compound as follows:

Liquid Chlorine - (gas atmosphere pressure)
Calcium hypochlorite granules
Sodium hypochlorite solutions
Calcium hypochlorite tablets

104-2.04B Liquid Chlorine. - Liquid Chlorine shall be produced and supplied in accordance with the provisions of AWWA Standard B301.

104-2.04C Hypochlorites. - Hypochlorites for use as disinfectants shall conform to the provisions of AWWA Standard B300.

104-2.05 Flushing. - The main shall be flushed prior to disinfection, except when the tablet method is used. The flushing velocity should not be less than 2.5 feet/second. It must be understood that flushing removes only the lighter solids and cannot be relied upon to remove caked deposits or heavy materials allowed to get into the main during laying. The disposal site for flushing water shall be as directed by the Engineer. Flushing shall be done after the pressure test is made, for mains not connected to existing systems.

104-2.06 Chlorine Application. - Disinfection of all portions of newly installed water systems, including all valves and appurtenances, by application of chlorine shall be as specified herein.

104-2.06A Continuous Feed Method. - Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/l available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedures described in Section 104-2.07 "Chlorine Residual Measurement" or other approved methods.

Table 1 gives the amount of chlorine required to produce 50 mg/l concentration for each 100 feet of pipe of various diameters. Solutions of one percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately one pound of calcium hypochlorite in 8.5 gallons of water.

During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period, the treated water shall contain no less than 25 mg/l chlorine throughout the length of the main.

Table 1
REQUIRED CHLORINE
50 Mg/l Concentration

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

104-2.06B Slug Method. - This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than 300 mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/l for at least 3 hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements made according to the procedures described in Section 104-2.07 "Chlorine Residual Measurement."

As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

104-2.06C Tablet Method. - Tablet disinfection is best suited to short extensions (up to 2,500 feet) and smaller diameter mains (up to 12 inches). Because the preliminary flushing step must be eliminated, this method shall be used only when scrupulous cleanliness has been exercised in laying of the pipe. Tablet method shall not be used if trench water or foreign material has entered the main or if the water is below 5 °C (41 °F).

104-2.06C(1) Placement of Tablets. - Tablets are placed in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All the tablets within the main must be at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position should be marked on the section to assure that there will be no rotation. In placing tablets in joints, they are either crushed and placed on the inside annular space, or, if the type of assembly does not permit, they are rubbed like chalk on the butt ends of the sections to coat them with calcium hypochlorite.

The adhesive may be any inert substance, approved by the Engineer. There shall be no adhesive on the tablet except on the broad side next to the surface to which the tablet is attached.

The number of Hypochlorite Tablets required for a minimum concentration of 50 mg/l of available chlorine in water is as indicated in Table 2. The number of tablets is based on 3-3/4 grams of available chlorine per tablet.

Table 2
HYPOCHLORITE TABLETS

Length of Section Feet	Diameter of Pipe Inches						
	2	4	6	8	10	12	18
13 or less	1	1	2	2	3	5	12
18	1	1	2	3	5	6	15
20	1	1	2	3	5	7	16
30	1	2	3	5	7	10	24
40	1	2	4	6	9	14	30

104-2.06(C) Filling and Contact. - When installation has been completed, the main shall be filled with water at a velocity of less than one foot/second. This water shall remain in the pipe for at least 24 hours.

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

104-2.07 Chlorine Residual Measurement. - The chlorine residual may be measured by the drop dilution method. The drop dilution method of approximating total residual chlorine, as specified herein, is suitable for concentrations above 10 mg/l. The procedure is taken from AWWA Standard M12 "Simplified Procedures for Water Examination."

104-2.07A Apparatus. -

(1) A graduated cylinder for measuring distilled water
(2) An automatic or safety pipet
(3) A dropping pipet that delivers a one milliliter sample is 20 drops. This pipet is for measuring the water sample and should not be used for any other purpose.
(4) A comparator kit containing a suitable range of standards.

104-2.07B Procedures. -

(1) Ascertain the volume of the comparator cell and using an automatic or safety pipet add 0.5 milliliters of orthotolidine for each 9.5 milliliters of distilled water to be added.
(2) Using a graduated cylinder, add a measured volume of distilled water.
(3) With the dropping pipet, add the water sample a drop at a time, allowing mixing, until a yellow color is formed that matches one of the color standards.
(4) Record the total number of drops used and the final chlorine value obtained.

(5) Calculate the milligrams per liter residual chlorine as follows:

(a) Multiply by 20 the number of milliliters of distilled water used in step (2).
(b) Multiply this product by the final chlorine value in milligrams per liter recorded in step (4).
(c) Divide the product found in step (b) by the total number of drops of water sample recorded in step (4).

104-2.08 Final Flushing. - After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than one mg/l. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

104-2.09 Bacteriologic Tests. - After final flushing, and before the water main is pressure tested, a sample or samples shall be collected in locations specified by the Engineer and tested for bacteriologic quality and shall show the absence of coliform organisms.

Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used in collection of samples. Samples shall be tested in accordance with, and shall conform to the requirements of the Santa Clara County Health Department, and/or the State of California Department of Public Health. Testing shall be performed at a Certified Laboratory approved by the City and at no cost to the City.

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the samples are satisfactory, the main may be placed in service.

104-2.10 Emergency Disinfection Treatment. - The procedures outlined in this section apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

104-2.10A Trench Treatment. - When an existing main is opened, either by accident or by design, the excavation will likely be wet and badly contaminated from nearby sewers. Liberal quantities of hypochlorite, in tablet form, applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

104-2.10B Main Disinfection. - The following procedure is considered as a minimum that may be used.

104-2.10B(1) Swabbing with Hypochlorite Solution. - The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a 5 percent hypochlorite solution (commercial bleach) before they are installed.

104-2.10B(2) Flushing. - Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

104-2.10B(3) Slug Method. - Where practicable, in addition to the procedures above, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in this section, except that the dose may be increased to as much as 500 mg/l, and the contact time reduced to as little as 1/2 hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated.

104-2.10B(4) Sampling. - Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

104-2.11 Measurement and Payment. - Separate payment will not be made for disinfecting water systems. Full compensation for such disinfecting shall be considered as included in the various contract items of work involved.

104-3 HYDROSTATIC TESTING

104-3.01 Description. - This work shall consist of hydrostatically testing newly installed water systems for leakage and soundness and the furnishing of all necessary materials and equipment required therewith. All water mains and service connection work shall be subjected to both pressure and leakage tests.

The procedure as specified herein is based on the assumption that the pressure and leakage test will be performed at the same time. Should the Contractor desire, separate tests may be made. If separate tests are made, the pressure test will be performed first.

In as much as trenches have to be backfilled immediately after the pipe has been laid for safety and other reasons, pressure and leakage tests shall be made after backfilling has been completed but before placement of permanent paving.

When the newly installed water system is connected to existing mains, bacteriological clearance shall be obtained before conducting pressure and leakage tests.

Each valved section of line shall be brought to test pressure of 200 psi unless otherwise specified and maintained for one hour minimum, using either pneumatic or hydraulic means to maintain the pressure. At the end of the test period, the volume of water pumped into the line shall be measured and recorded as the leakage for that test section.

For acceptance of the water system, each test section shall not exceed the allowable leakage as determined in accordance with the following formula:

$$L = SD \times \sqrt{P} \div 133,200$$

in which L is the maximum acceptable leakage (Gallons/Hr.);
S is the reach or length of the test section in feet;
D is the diameter of pipe in inches; and
P is the test pressure

If the leakage rate exceeds the allowable limit, the pressure shall be maintained for a sufficient length of time as necessary to locate the leak or leaks. After the leak or leaks are corrected to the satisfaction of the Engineer, the hydrostatic pressure and leakage test shall be repeated.

104-3.02 Test Report. - The Contractor shall maintain a record of all hydrostatic tests made, and shall submit to the Engineer a written report of the results of such tests. The report shall include: (1) date and time of test, (2) description of pipe section tested, (3) average pressure used, (4) duration of test, (5) amount of measured leakage, and (6) location of leaks, if any, and corrective action taken. The Engineer shall monitor all tests and the test report shall be signed by the Contractor and the Engineer.

104-3.03 Measurement and Payment. - Separate payment will not be made for testing water systems. Full compensation for such testing shall be considered as included in the various contract items of work involved.