SPECIFICATIONS FOR MATERIAL

Ductile Iron (DI) Pipe: All Ductile Iron pipe shall comply with the latest revision of AWWA Standard C151 and shall be cement mortar lined in conformance with the latest revision of AWWA Standard C104. All pipe shall have Push-on Joint ends complete with gasket unless specified otherwise and shall be Pressure Class 350 in all sizes from 6" to 12" unless specified otherwise. Pipe shall be furnished with polyethylene encasement complying with the latest revision of AWWA Standard C105. All pipe shall be manufactured by Pacific States, Clow/McWane, U.S. Pipe, or Griffin pipe.

Polyvinyl Chloride (PVC) Pipe: All pipe shall be Class 150, D.R. 18, unless otherwise specified and shall comply with the latest revision of AWWA Standard C-900. The pipe shall have ductile-iron pipe equivalent outside diameter dimensions and shall have Push-on Joint ends complete with gasketa. All pipe shall be manufactured by PW pipe, J-M Pipe, CertainTeed, Diamond Plastic Corp., Vinyl Tech, Uponor, or Royal Pipe.

Cement Mortar Lined and Cement Mortar Coated Steel Pipe (CL&C): All cement mortar lined and coated steel pipe shall be fabricated from steel cylinder ASA schedule as indicated on the drawing, with ASTM A53 test pressure and ASTM A36 physical properties. Cement mortar protective coating shall be 3/4" for all pipe sizes. The lining shall be 1/2" for 12" and larger pipe and 3/8" for 6" and 8" pipe, and conform to the latest revision of AWWA C205 Standard. Cement Mortar Coating shall be reinforced with 14 gauge wire mesh or spirally wound wire in center of coating. All CL&C steel pipe required for the water main installation shall be as specified on the drawing.

PVC "Certa-Lok" VIP Restrained Joint Pipe: All PVC "Certa-Lok" VIP Restrained Joint pipe shall be manufactured by CertainTeed. Certa-lok shall comply with the latest revision of AWWA Standard C-900. Pipe is made to ductile-iron-outside-diameter (DI OD), DR 18, Class 150, in 20' laying lengths, with twin gasket Certa-Lok couplings, nylon splines, and rubber rings.

Steel (SH) Pipe: All Steel pipe shall be as specified on the drawings.

Polyethylene (PE) Pipe: This section is for PE pipe for mains or services sizes 4" and larger and shall only be used when specified on the drawings. All PE pipe shall be high density polyethylene (HDPE) complying with the latest revision of AWWA Standard C906 and PPI PE 3408. PE pipe shall conform to the outside diameter for the ductile-iron sizing system (DI OD) in Table 7 of AWWA C906. For water mains where working pressure will be less than 100 PSI, SDR 17 shall be used. For working pressure between 100 and 160 PSI, SDR 11 shall be used. All pipe shall conform to NSF Standard #14 and #61. All pipe shall either be blue or have blue printing on it to designate its use as a potable water pipeline. HDPE pipe shall be manufactured by CP Chem (Performance Pipe-Driscoplex).

Pipe Fittings: All fittings shall be as specified on the drawings and shall be Ductile Iron complying with the latest revision of AWWA Standard C153 for push-on and mechanical joint fittings and C110 for flanged fittings. All fittings shall either be cement mortar lined in conformance with the latest revision of AWWA Standard C104 or coated with fusion-bonded epoxy inside and outside in conformance with the latest revision of AWWA Standard C116. All fittings shall be manufactured by U.S. Pipe, Union/Tyler, Sigma Corp., or Star Pipe.

Gate Valves: All gate valves shall meet or exceed the latest revision of AWWA Standard C515 for reduced wall, resilient-seated gate valves (or C509 for resilient-seated gate valves) and shall be provided with left hand to open, ductile iron (or cast iron) body with epoxy coating inside and outside complying with the latest revision of AWWA Standard C550, nut operated non-rising stem with 2" square operating nut, two O-ring stem seals above the thrust collar and one below, O-ring gaskets and 304 stainless steel bolts and nuts on bonnet and stuffing box and EPDM rubber encapsulated wedge (when available at no extra cost). All gate valves shall be manufactured by Mueller Company, M & H Valve and Fitting Company, Kennedy Valve Co., Clow Valve Co., American Flow Control, American AVK Co. or U.S. Pipe. Two inch and smaller gate valves shall be Clow 125 with standard thread, bronze with wheel, and be manufactured by Milwaukee (No. 105) or Nibco.

Butterfly Valves: All valves greater than 12" nominal size shall be butterfly valves. All butterfly valves shall comply with the latest revision of AWWA Standard C504, and shall be provided with "O-ring" packing, left hand to open, nut operated with 2" square operating nutto, ductile iron body, stainless steel shaft, resilient seat and heavy duty actuator. The butterfly valves shall be manufactured by Mueller Company, M & H Valve & Fitting Company, Pratt Company or Kennedy Valve Co.

Pressure Reducing Valves: All pressure reducing valves shall be manufactured by Cla-Val Company. The model number, body construction, and flange drilling shall be as specified on the drawings. The drawing may indicate that the pressure reducing valve will be supplied by California Water Service Company. All valves shall have factory set controls or pilots as specified on the drawings. All control or pilot piping shall be copper tubing or brass pipe. PRV vaults shall be as specified on the drawings.

Check Valves: Unless specified otherwise, all check valves shall be swing type with spring and lever and shall comply with the latest revision of AWWA Standard C508. The Valves shall have class 125 flanged ends unless shown otherwise on the drawing. Check valves shall be manufactured by Mueller, Clow, M&H, or Kennedy.

Valves for Tapping: All gate valves for tapping purposes shall be Resilient Seat type valves. The valve for tapping shall be manufactured by Mueller Co., Kennedy Valve Co. or Clow Valve Co.

Tapping Sleeves: All tapping sleeves shall be all stainless steel including flange and shall only be used when specified on the drawings by CWS. Tapping sleeves shall be JCM Model 432, Mueller Model H304, Smith Blair 622-663 or Ford style FTSS.

Valve Casings and Covers: All valve casings and covers shall be fabricated as shown on the latest revision of drawing CW-14 as applicable.

Fire Hydrants: All fire hydrants shall be as specified on the district specific drawing or as approved by CWS Co. district personnel. For typical Fire Hydrant details see the latest revision of drawing CW-380.

Fire Hydrant Buryes: All fire hydrant buryes shall be manufactured from Ductile Iron to ASTM A536 and have a minimum working pressure rating of 200 PSI. Buryes shall be manufactured by Clow, SBF, Sigma, or Star Pipe.

Service Materials: All 1" and 2" service material specifications except copper tubing and plastic PE pipe shall be as shown on the latest revision of drawings CW-555 or CW-436 which includes alternate manufacturers. All service material specifications for services larger than 2" shall be as specified on the plan and/or as specified on the latest revision of the CW drawing for that size service.

Saddles: All saddles shall be as specified on the latest revision of the applicable size service standard drawing: 1" = CW-555 and 2" = CW-436.

Solder: All solder shall be lead free.

Copper Tubing: All copper tubing shall conform to the latest revision of ASTM Specification B88 and be Type K soft.

Polyethylene (PE) Service Pipe: All PE plastic pipe for services shall comply with the latest revision of ASTM D2239 with a Standard Code Designation of PE 3408. Dimensions and tolerance of pipe shall be as specified in Table 3 of the latest revision of AWWA Standard C901 for PC 200-IDR7. This is a high density polyethylene plastic pipe conforming to the inside-diameter dimensions of iron pipe sizes and having a 200 p.s.i. pressure rating. The pipe shall be approved by N.S.F. as suitable for potable water products.

Meter Boxes: All meter boxes for 1" services and 2" services shall be as specified on the latest revision of drawings CW-555 or CW-436. All meter boxes for services larger than 2" shall be as specified on the plans and/or as specified on the latest revision of the CW drawing for that size service. All meter boxes for 1" services and 2" services shall be supported by placing bricks or 2"X4" pressure treated lumber under two sides of the base of the meter box.

Vaults: Vaults for appurtenances other than meters (such as Check Valves or PRV's) shall be as specified on the drawings.

Machine Bolts: All steel bolts and nuts used for flanged fittings, flexible couplings, or other bolted appurtenances shall be 304 stainless steel. Ductile iron bolts are acceptable when the appurtenance is made of ductile iron and comes with option of ductile iron bolts, such as mechanical joint fittings. Anti-gall lubricant shall be used with stainless steel bolts & nuts.

2" Blow Off Assemblies: All materials for 2" blow off assemblies shall be as shown on the latest revision of drawing CW-122.

Flexible Couplings: The Company may require flexible couplings to be epoxy coated if soil conditions are determined to be corrosive. If the flexible coupling is steel the sleeve must be a minimum of 10 inches long. If the flexible coupling is ductile iron then a standard sleeve length may be used unless the drawing specifies otherwise. Flexible Couplings shall be manufactured by Smith Blair, Ford Meter Box Company, or Romac Industries.

Solid Sleeves: All solid sleeves shall be made of ductile iron and shall be manufactured by Tyler Pipe or Union/Tyler Foundry.

PVC High Deflection Couplings: All PVC high deflection couplings shall conform to the latest revision of AWWA C-900 and shall be manufactured by CertainTeed.

PVC Closure Couplings: All PVC closure couplings shall conform to the latest revision of AWWA C-900 and shall be manufactured by CertainTeed.

2" Ball Valves: Two inch ball valves shall be as shown on the drawing and shall be manufactured by Mueller, Jomes Jones, Ford Meter Box Company or AY McDonald.

Tracer Wire: Tracer wire shall be minimum #12 AWG solid copper wire with 45 mils of high molecular weight polyethylene (HMWPE) insulation, UL Listed, rated for direct burial, color blue and installed with all pipe including PVC, polyethylene and ductile iron pipe. For installation details see the latest revision of drawing CW-850.

SPECIFICATIONS FOR INSTALLATION OF DUCTILE IRON AND POLYVINYL CHLORIDE PRESSURE PIPE AND APPURTENANCES

Permits: All specification sheets, city/county or other environmental permits necessary for the installation of facilities must be obtained by the company and be on the job site prior to and during construction.

Compliance with all the Rules and Regulations of the California Occupational Safety and Health Act (CAL OSHA), Public Law 91-596, the "Williams' Steiger Occupational Safety and Health Act of 1970", is required on this project. The work practices for all pipe shall be in accordance with the latest revision of the American Water Works Association Publication C-600 Standard for Installation of Ductile Iron Water Mains and their Appurtenances, C-605 Standard for underground installation of Polyvinyl Chloride (PVC) Pressure Pipe and fittings for water, and M23 Manual of Water Supply Practices for PVC Pipe—Design and Installation.

Please note direct discharge of highly chlorinated water to the environment is expressly prohibited. Refer to "Specifications for Dechlorination of Flushed Water" for more information. The Contractor shall comply with environmental laws and regulations as set forth by all federal, state and local agencies.

Materials: All materials installed for the facilities to be constructed by the Contractor must comply with the drawings and "Specifications for Material". No materials are to be supplied or furnished by California Water Service Company unless specifically indicated on the plans for special installations. All materials must be on the job site and inspected prior to start of construction. Any pipe, valve, or appurtenance whether installed or not, which in the opinion of the Company, does not meet the requirements of these specifications or otherwise found unfit, shall be rejected as being unfit, and shall be immediately removed from the job site.

Line and Grade: The horizontal and vertical alignment for installation of the pipe shall be established in the field by the Contractor in accordance with the plans and specifications. Location of water facilities including finished grades and elevations shall be staked with offsets on site by the Contractor prior to start of construction. Final elevations of installed facilities, valve boxes, valve covers, manholes, etc. shall be signed off by the California Water Service Company representative prior to acceptance of facilities.

Cover: Under normal conditions all mains shall be covered to a depth of four feet below the finished grade over the pipeline, unless specified otherwise on the plans. Prior approval must be obtained from California Water Service Company to install mains with greater or less than four feet of cover.

Separation Between Water Mains and Sanitary Sewers or other Facilities: Water mains shall be installed at least ten feet horizontally from and one foot higher than sanitary sewers located parallel to the main, unless specified otherwise on the plans. Install water mains a minimum of one foot higher than sanitary sewers crossing the main. At all storm and sanitary sewer crossings, a full pipe length shall be centered over the sewer pipe to keep an adequate distance between the sewer and the water pipe joints. A 20 feet length of PVC or 18 feet length of DI pipe is considered to be a full pipe length. The State of California Department of Health Services "Criteria for the Separation of Water Mains and Non-potable Pipelines" shall be followed when installations can not meet the "Basic Separation Standards". A minimum vertical clearance of twelve (12) inches shall be maintained between the water main and all foreign structures, and a minimum horizontal clearance of five (5) feet shall be maintained between utilities unless otherwise indicated on the plans or approved by the Company. Refer to "Pipeline Crossing information" shown on the plans for information of water main installations crossing other proposed or existing facilities. Company approval must be obtained prior to making any changes from the plans. This includes changing grade or alignment to avoid structures, other pipes, manholes, or any other fixed objects which may be encountered during installation. As per company standards, changes in cover over the pipeline may require the installation of a fabricated steel, cement mortar lined and coated offset.

Workmanship: The pipe shall be installed to a true line and grade except on curves where ductile iron pipe may be installed with joint deflections between adjacent lengths of pipe not to exceed 3 degrees for ductile iron pipe sizes 6", 8", and 12". PVC pipe shall not be deflected at joints for horizontal or vertical deflection. No joint deflection shall be allowed in joints between fittings and valves. "CertainteedT PVC Deflection Couplings shall be used with PVC C-900 between adjacent lengths of pipe to attain up to 5 degrees deflection at the joint when required.

When assembling a PVC pipe to an iron fitting, valve, or appurtenance (push-on), remove all but 1/4 inch of the factory made bevel from the spigot end of the pipe. Bottom the pipe in the bell of the iron fitting.

Field-cut lengths of PVC and DI pipe may be used for making connections to valves, fittings, appurtenances, and closures where necessary. The cutting and beveling of the pipe for inserting into the bell shall be done by the use of a square cutting tool approved by the Company and manufactured for this purpose, without damage to the pipe. The bevel of the pipe shall be the same as required for the fitting.

Trench Bottom: The bottom of the trench shall be smooth and free from pieces of rock or other material that would tend to scratch, puncture or break the pipe or damage the polyethylene encasement used on ductile iron pipe. If rocks or stones are encountered, they shall be removed to a depth of six inches below bottom of trench and the void filled with material tamped to grade. A six inch layer of sand shall be placed in the trench bottom to provide a firm, stable, and uniform support for the full length of the pipe, except at the joints where bell holes shall be dug two inches below the surface so that the pipe will not be supported by the joint. Under no circumstances shall the bell hole undermine the support for the fittings or valves.

Valves and other various fittings may be required to be supported by a concrete cradle if it is determined by the Company that the bedding in the trench bottom can not be properly compacted to provide adequate support.

When an unstable subgrade condition is encountered that could provide inadequate pipe support, the Company shall require additional trench depth to be excavated, refilled and compacted with suitable foundation material.

PVC or DI pipe or appurtenance shall not be laid in water, or when, in the opinion of the Company, the trench conditions or the weather are unsuitable for construction. Any water main which has been submerged shall be removed from the trench and be replaced. The trench shall be dewatered whenever running or standing water occurs in the trench bottom and the removal shall continue until the pipe has been installed and the backfill has been placed to a sufficient height to prevent the pipe from being submerged in water.

IMPORTANT: All trench excavations shall be in accordance with the Rules and Regulations of the California Occupational Safety and Health Act (CAL OSHA). This includes all necessary sharing determined by either the depth of trench and/or soil conditions.

Pipe and Appurtenances Handling: All water main and appurtenances shall be carefully lowered into the trench by means of padded slings, hooks, pipe tongs, or other suitable equipment consistent with safety, in such a manner to prevent damage to the exterior and interior pipe or appurtenance surfaces. Under no circumstances shall any material be dropped or dumped into the trench. Any foreign material inside the pipe shall be removed and the interior of the pipe kept clean during installation. PVC pipe, ductile iron pipe, or appurtenance with damaged exterior or interior surfaces shall not be installed.

During installation the open ends of the pipe shall be covered at night or when no work is in progress at that point to prevent entrance of trench water, animals, or other foreign matter.

On all pipe, a continuous strip of tracer wire (per material specification) shall be taped to the top exterior surface of the pipe per the latest revision of drawing CW-850. Tracer wire splices using appropriate connectors are required at all locations where the wire is cut.

A polyethylene encasement shall be installed over ductile iron pipe, fittings, and appurtenances per latest revision of AWWA Standard C105 "Polyethylene Encasement for Ductile Iron Piping" and per the plans and specifications, or as requested and directed by the authorized Company representatives.

Note: Ductile iron fittings and appurtenances installed on PVC C-900 main shall require polyethylene encasement with a 2 feet overlap onto the PVC main. This overlap to be secured to main per the latest revision of AWWA Standard C105.

Rubber Ring Joints for PVC C-900 and Ductile Iron Pipe:
Push-on type rubber ring joints with rubber rings for integral bell ends shall be joined as follows: The ring groove, bell socket and plain end should be wiped clean. Insert the gasket making sure that it faces the proper direction and that it is correctly seated. The plain end shall be beveled and free of any sharp or rough edges which may damage or dislodge the gasket. Lubricate the entire outside end of the pipe including the pipe bevel, also lubricate the exposed face of the rubber ring gasket in the bell (See "pipe joint lubricant" below). Push the plain end into the bell by hand or with the use of a bar and block until it is completely seated, keeping the joint straight while pushing. Construction machines should not be used to push the pipe into a pipe bell end or a fitting bell end. After assembly, the resulting position of the rubber ring shall be checked with a feeler gauge.

If "Field Lok" gaskets are specified on the plans, the gasket shall be installed in accordance with the manufacturer's recommendations.

If "TR FLEX" restrained joint system is specified on the plans, the joint assembly shall be installed in accordance with the manufacturer's recommendations.

Pipe Joint Lubricant: Pipe joint lubricant shall be as specified by the pipe manufacturer and shall be NSF approved for use in potable water systems. When specified by the Company, or at the option of the Contractor, Silkatyx spray-on gasket lubricant may be used as an alternative to the traditional lubricant supplied by the pipe manufacturer. This spray-on lubricant may be helpful in reducing taste and odor complaints from excessive traditional lubrication, particularly on dead end mains.

When using Silkatyx, follow these instructions: After cleaning the bell and spigot of all grease, dirt, or foreign material, apply a thin film of Silkatyx gasket lubricant to the gasket and pipe spigot. Use care on rolled fittings and PVC high deflection couplings, as the product will set up and cause the gasket to roll. Therefore, the gasket must be installed for a long period before attempting to roll a fitting, the traditional pipe lubricant should be considered. Use 16 fluid oz. can of Silkatyx will cover approximately 40 – 6" joints, 30 – 8" joints or 20 – 12" joints. Silkatyx gasket lubricant is currently distributed by Future Tools, Inc., Wellston, OH 45692, 1-800-576-9707.

Mechanical Joints: Mechanical joints shall be joined as follows: The socket and plain end should be wiped clean and any excess coating in the bell socket be removed. The plain end, bell socket, and gasket should be washed with a soap solution or lubricant furnished with the gaskets to improve the seating of the gasket in the socket and to help the various parts slide together along the pipe. Place the gland on the plain end with the lip extension toward the plain end of the pipe, followed by the gasket with the narrow edge of the gasket toward the end of the pipe. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during the assembly. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Partially tighten the bottom bolt first; then the top bolt; next the bolts at right angles to the first bolts. Repeat this process until all bolts are torqued to a value between 75 and 90 ft-lbs.

If "Mega Lug" mechanical joint retainer glands are specified on the plans, the gland assembly shall be installed in accordance with the manufacturer's recommendations.

Thrust Blocks: Concrete thrust blocks shall be provided for all fittings to prevent movement when the main is under pressure. This includes tees, ells, reducers, caps and plugs. Forms are required and shall be provided by the contractor. These forms shall be smooth, mortar tight and of sufficient strength to maintain shape during the placing of the concrete. All concrete thrust blocks shall be constructed per the latest revision of drawing CW-435.

Embedment Backfill: The embedment backfill is 6 inches of sand bedding below the pipe and 12 inches of sand backfill above the pipe (see sand definition below). Care must be taken to compact the sand backfill material solidly around and under the pipe. Small tampers and vibrators are allowed for compacting near the pipe and over the pipe after a minimum of 6 inches of sand backfill has been placed over the pipe. Flooding, jetting or puddling may be employed for compaction in the first lift although great care must be taken to prevent drainage or flotation of the pipeline. Apply only enough water to give complete saturation. Erosion of support at the pipe sides and bottom by water jetting must be prevented. Rocks or hard lumps are not permitted in the embedment backfill or final backfill.

Sand is defined as material free from organic matter and clay with a sieve gradation by weight as follows:

Sieve Size	% Passing Sieve
No. 4	100
No. 200	0 – 5

Final Backfill: In areas where required, the permanent pavement and temporary pavement replacement must comply with specifications of the local governing authorities. All backfill above the sand embedment backfill must meet compaction requirements of the local governing agency. All pavement broken shall be replaced in strict accordance with the requirements of the local authorities, or local agency requirements, in accordance with the latest revision of drawing CW-236.

Other Facilities: All existing facilities, such as but not limited to sewers, gas mains, water mains, telephone conduits, and power or telephone poles which may be located close to trench operations must be protected by the Contractor. If any of these facilities are damaged by the Contractor, repairs shall be made to the satisfaction of the interested parties at the Contractor's expense.

Valve Casings and Covers: A valve casing with cover shall be installed for each gate valve, butterfly valve, 2" blow off assembly or when specified on the plans per the latest revision of drawing CW-439. The valve cover and frame for valves in paved and unpaved areas shall be per the latest revision of drawing CW-14. The valve cover frame shall be set in a ring of concrete a minimum of 24" in diameter and three inches thick or per local governing agency's standards whichever is greater. All valve casing covers must be placed flush with the finished grade of the surrounding area.

2" Blow Off Assemblies: A blow off assembly as shown on the latest revision of drawing CW-122 shall be installed for each dead end capped main. The assembly is to include a valve casing and cover.

Services and Meter Boxes: Services and meter boxes shall be installed as shown on the latest revision of drawings CW-555 for 1" services, CW-436 for 2" services, and for larger than 2" services as designated on the plans and/or the latest revision of the CW drawing for that size service. The 1" and 2" service pipe shall be installed at a depth of 30" or more from finished grade over the service pipe and in no event shall the depth be less than 18". The Contractor must get prior approval from the Company to install service pipe with less than 30" of cover.

All meter box locations must be approved by the Company and the boxes must be installed flush with finished grade of the surrounding area at the meter box cover. The meter boxes for 1" and 2" services shall be supported by placing 2"x4" treated lumber or bricks on two sides of the meter box's base. Avoid postal and street pedestals, driveways, trees/bushes, fencing, sewer lines, and other utilities.

Saddles and saddle tapping are required for all service connections made on PVC pipe. When making this type of connection, proper equipment must be used which attaches to the corporation stop permitting the cutting tool to be fed through the corporation stop to cut a hole in the pipe. It is important that the cutting tool be a sharp shell type (hole) cutter which will retain the coupon and be designed to accommodate walls as heavy as DR 18 pressure class 150. The shell cutter shall be lubricated on the outside only and not on the inside of the cutter with a recommended lubricant. Do not drill a hole in the PVC pipe with a twist drill or auger bit.

Direct tapping machines for service connections on ductile iron pipe must be approved by California Water Service prior to direct tapping ductile iron mains. Plastic PE pipe shall be cold flared to match recessed fittings or is to have outside end bevels for instotite fittings. Forming tool for bevels shall be Mueller's beveling tool number H10817 or approved equal.

Connection to Existing System:
The Contractor shall furnish to the Company the necessary fittings, valves, pipe, and joint material required to connect the new mains to the existing system.

The Contractor must adjust from the nominal line and grade to match the existing facilities.

The Contractor is to complete the piping and maintain the specified clearance from existing main as shown on the drawings. The Contractor shall make the excavation for the tie-in. The trench shall be left in a safe condition for the Contractor to complete the connections. If the trench is considered unsafe for workers, the Company may require the Contractor to return and adequately excavate for the tie-ins at the Contractor's expense. After the Company has inspected the connection, the Contractor shall install concrete thrust blocks, install valve casings and covers, and backfill the excavation. The Contractor shall then replace any pavement that was cut for the excavation.

The Company reserves the right to perform the tie-ins to the existing system if they deem it desire. In this situation, the Contractor will not be paid for the tie-ins as bid.

Pressure Test: Prior to any testing, at least seven days should elapse after the last concrete thrust block was poured if Type I portland cement was used and three days if high-early-strength Type III portland cement was used. A preliminary pressure test shall be made by filling the mains with water and allowing them to stand under regular system pressure for a period of at least twenty-four hours. After completion of the preliminary test, the Contractor shall make a hydrostatic test by raising the pressure in the main to 50 pounds per square inch above the normal static pressure at the point of observation with a minimum test pressure of 150 pounds per square inch. A calibrated pressure chart recorder and a water meter shall be provided by California Water Service Company. The hydrostatic test shall not be conducted without a Company representative present. The pressure that the test is started at shall be maintained for a minimum of four hours. The test shall start one hour after the same pressure. If there is a pressure drop, the Contractor shall pump more water into the main through the water meter to bring the main back to its starting pressure. The leakage is the calculated volume of water pumped into the main through the meter. The leakage shall be measured accurately during the test period to determine that the leakage rate does not exceed the values shown in Table IA for ductile iron pipe and Table IB for PVC C-900 pipe. There shall be no leakage, zero gallons per four hours test period at 150 p.s.i. for the portion of pipeline that is steel pipe CL&C with welded joints. An air test may be used as an alternate method for the steel pipe CL&C welded sections. Test pressure to be 150 p.s.i.g. held for a four hour duration, with no volumetric loss during test period. A calibrated pressure chart recorder will be provided by California Water Service Company. The necessary tape, connecting pipe, and valve fittings shall be provided by the Contractor. Any leaks or failures that develop during the test shall be repaired by the Contractor immediately.

If the mains fail to meet requirements of the hydrostatic test, the Contractor shall, at his expense, make repairs to reduce the leakage. The repair work shall be continued until a satisfactory test is made.

Disinfection of Mains: All mains that are installed by the Contractor shall be disinfected by the Contractor in accordance with the "Specifications for Disinfection of New Mains."

Inspection: The Company reserves the right of access to the work at all times for the purpose of inspecting and the Contractor shall permit the Company's representative to make an inspection at any time. The Contractor shall notify the Company's local manager at least 48 hours prior to any work being started at the project site. The Company will normally provide no more than 2 inspections per day during normal working hours. The trench must be left open until the Company has inspected the new installation and approved that portion of trench to be covered. If the trench is covered prior to the Company's inspection, the Contractor will be required to uncover the trench at the Contractor's expense.

Protection: The Contractor shall at all times provide suitable and adequate danger signals and barricades. If necessary, the Contractor shall also provide temporary bridges across the trench to permit free access to and from private driveways or traveled roads or streets. No street shall be closed unless a permit has been obtained from the appropriate authority.

Specifications and Drawings: Specifications and drawings shall be taken together and anything shown on the drawings and not covered by the specifications or covered by the specifications and not shown on the drawings shall be considered as though it were covered by both specifications and drawings. Any points of disagreement should be referred to the Company's representative as soon as possible to resolve any possible misunderstandings.

Clean Up: Upon completion of the work, the Contractor shall remove all rubbish and waste materials resulting from the Contractor's operations and leave the ground along the route of the pipeline in a neat and clean condition. The Contractor shall be responsible for removal of all excess spoil from the trench excavations, the Company shall not accept any responsibility.

Guarantee of Workmanship: Notwithstanding Owner's acceptance of the new facilities, the Contractor shall guarantee all of his workmanship for a period of one calendar year from and after acceptance of the work by the Owner. The Contractor shall repair and make good any defects or imperfections in the work at his sole cost and expense. If deficiencies develop during the Guarantee calendar year, such as but not limited to: leaks in the pipeline or appurtenances, settlement of trenches, or deteriorating pavement due to faulty or imperfect workmanship, the owner retains the right of making repairs and the Contractor is responsible for the cost of said repairs.

TABLE IA

ALLOWABLE LEAKAGE PER 1000 FT. OF DUCTILE IRON PIPELINE

Average Test Pressure	Nominal Pipe Diameter – inches							
	6	8	10	12	14	16	18	24
(PSI)	GALLONS PER HOUR (GPH) *							
200	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.55
175	0.59	0.80	0.99	1.19	1.39	1.59	1.79	2.38
150	0.55	0.74	0.92	1.10	1.29	1.47	1.66	2.20

* If the pipeline under test contains sections for various diameters, the allowable leakage will be the sum of the computed leakage for each size.

TABLE IB

ALLOWABLE LEAKAGE PER 1000 FT. OF PVC C-900 PIPELINE

Average Test Pressure	Nominal Pipe Diameter – inches		
	6	8	12
(PSI)	GALLONS PER HOUR (GPH) *		
200	.57	0.76	1.15
150	.50	0.66	.99

* If the pipeline under test contains sections for various diameters, the allowable leakage will be the sum of the computed leakage for each size.

SPECIFICATIONS FOR DISINFECTION OF NEW MAINS BASED ON THE PROCEDURES OUTLINED IN THE LATEST REVISION OF ANSI/AWWA C651

General Instructions:

1. Precautions shall be taken to prevent soiling of pipe, fittings and other materials. Pipe and fittings shall be stored so as not to accumulate mud or water, and other material shall be stored in a clean, dry location. Particular care shall be taken to keep rubber gaskets and pipe ends clean.

2. All pipe shall be clean before lowering the pipe into the trench.

3. When the main is left unattended, even for a short time, the ends shall be plugged to prevent the entrance of foreign material or small animals.

4. Loading of new mains: A reduced pressure principle (RPP) backflow assembly is required on all new main installations to prevent any chlorine used for disinfection from entering the potable water supply. The backflow assembly must be tested by a certified backflow assembly tester within the last twelve months. This test will be verified by the California Water Service Company Inspector. The backflow assembly can be placed on a fire hydrant. Backflow assemblies and annual testing will be supplied by, and be the responsibility of the installing contractor.

5. Apply the chlorine, using one of the methods described under "Chlorine Application Methods." A California Water Service Company Inspector is to measure the chlorine concentration to insure that a 50 ppm concentration has been applied (not to exceed 200 ppm). Samples with a high chlorine concentration must be analyzed with a high range total chlorine test kit. Hach Catalog Number 2444400, or equivalent may be used

6. Allow heavily chlorinated water to stand therein for a contact period of at least twenty-four hours. If the water temperature is less than 41°F, the water shall remain in the pipe for at least 48 hours. A California Water Service Company Inspector is to measure the chlorine after this contact period. When using the tablet method, there must be a detectable free chlorine residual at the end of the required hold time. When using liquid chlorine, the free chlorine residual must be at least 10 ppm at the end of the required hold time. If the concentration has dropped to less than 10 ppm, then the mains must be superchlorinated by the continuous feed method, and the required contact period shall be repeated due to the high chlorine demand. Equipment used to superchlorinate by the continuous feed method will be provided by the installing contractor.

7. At the end of the contact period, flush the main thoroughly (See Specifications for Dechlorination of Flushed Water). The California Water Service Company Inspector is to test for chlorine to demonstrate that the water leaving the main has no more chlorine than in the water entering the main.

8. The Company's representative will collect two sample sets at least 24 hours apart and work with the Water Quality (WQ) Department in having them analyzed for coliforms and heterotrophic bacteria. The samples should be taken from a combination blow off and sampling device illustrated in drawing CW536 or a service located near the end of the chlorinated main. The samples shall start and finish within AWWA Standard C651 and sample set (two samples 24 hours apart) shall be collected every 1,200 ft., and one set from the end of the line and one set from each branch or dead-end.

9. A WQPM will review the bacteriological results and determine if the main can be put into service. Further flushing and analytical work will be necessary if the bacteriological tests are positive. If any follow-up example tests positive, the main must be superchlorinated by the continuous feed method. Equipment used to superchlorinate by the continuous feed method will be provided by the installing contractor. The main will only be put into service with two consecutive sets of negative bacteriological results and a free chlorine residual between 0.3 ppm and 1.0 ppm.

10. Before a tie-in is performed, the inside surface of all materials such as the tee, pipe nipples, couplings, and tapping sleeve must be swabbed with NSF-grade 12.5% sodium hypochlorite or heavily dusted with H.T.H. granules.

Chlorine Application Methods:

Safety Notes: Chlorine tablets and solutions should be handled with care, as they are dangerous to the eyes, irritating to the skin, and will damage shoes and clothing. Minimize your exposure by reading and finding the MSDS available should an emergency occur. Follow the guidelines for protecting yourself, asking your supervisor when in doubt and by erring on the safe side by using respirators, protective clothing and other protective equipment.

Method No. 1 – H.T.H. Tablet Method

This method works well for short jobs and for small diameter pipe of any kind. It cannot be used where trench water has been present. The tablets cannot be flushed prior to disinfection, so the method requires that the pipe be kept clean during laying.

Use Permatex (Loctite) Form-A-Gasket No. 1 Sealant (Permatex (Loctite) Catalog No. 80001), to fasten the required number of H.T.H. tablets (See Tables IIA and IIB) to the top of each length of pipe. H.T.H. tablets may be oval or round, must be NSF approved, and have 65% free chlorine.

Permatex (Loctite) No. 1 is a fast drying, hard-setting gasket sealant designed for sealing rigid materials and flanges, or patching holes and joints where permanent assembly is desired. Please refer to its M.S.D.S. for health and safety precautions in its use. Do not use Permatex No. 2 (Loctite), which is a slow-drying, non hardening sealant used where sealing is more important than adhesion. Tubes of Permatex (Loctite) No. 1 may be purchased locally at any auto parts store. The tablets may be fastened to the pipe before it is placed in the trench provided the top of pipe is marked to avoid the possibility that the pipe may be rotated.

H.T.H. tablets should be removed at the end of the day, when pipe is not installed in the ground the same day tablets are applied. Reuse those tablets in the following days if still intact. This is to prevent moisture from reducing the amount of chlorine available for disinfection.

In addition to the tablets, place 10 ounces of H.T.H. granules at the upstream end of the first length of pipe into which water will flow. This will insure that heavily chlorinated water flows into crevasses caused by couplings and valves. For long runs, this should be repeated about 500 feet.

When using flexible couplings, apply NSF-grade sodium hypochlorite with a spray bottle method, or place additional H.T.H. granules in the annular space between the coupling and the pipe.

When installing CL&C pipe, one cap full of H.T.H. granules should be placed in the pipe after the pressure test and before tie-ins. NSF-grade sodium hypochlorite can be used when main needs to be placed in service as soon as possible, and can be flushed to the system chlorine reading.

Fill the pipe very slowly and proceed as outlined under the "General Instructions".

TABLE IIA

H.T.H. Oval Tablet Method No. 1 of Main Chlorination
Number of Tablets Specified for Disinfection of at least 50 ppm

Length of Section	DIAMETERS															
	4"		6"		8"		10"		12"		14"		16"		18"	
	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm
18'	1	95	2	84	3	71	4	61	5	52	7	54	9	53	11	51
20'	1	85	2	75	3	64	4	54	6	56	8	55	10	53	12	50
30'	1	56	2	50	4	57	6	54	8	50	11	51	15	53	18	50
40'	2	85	3	56	5	53	8	54	10	52	15	52	19	50	24	50

TABLE IIB

H.T.H. Round Tablet Method No. 1 of Main Chlorination
Number of Tablets Specified for Disinfection of at least 50 ppm

Length of Section	DIAMETERS															
	4"		6"		8"		10"		12"		14"		16"		18"	
	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm	# of Tabs	ppm
18'	1	215	1	95	1	55	2	70	2	50	3	55	3	54	5	55
20'	1	200	1	85	1	50	2	60	3	65	4	65	5	60	6	60
30'	1	130	1	60	2	65	3	60	4	60	5	55	7	55	8	50
40'	1	100	2	85	3	75	4	60	5	55	7	55	9	55	11	55

Method No. 2 – 12.5% Liquid Chlorine (Sodium hypochlorite)

This method is general in scope and must be used when it is necessary to re-chlorinate an existing main. It may also be used on new mains, in which case place 10 ounces of H.T.H. granules at the upstream end of the first length of pipe into which water will flow, and every 500 feet thereafter.

This method consists of introducing a 12.5% chlorine solution into water which is being used to fill water main. The 12.5% chlorine solution must be NSF approved and can be purchased through several vendors.

Procedure:

1. Calculate the total vol