

SECTION 4

PIPELINE INSTALLATION

4-01. **Scope.**

This section covers the installation of pipelines and appurtenances, including trenching, laying, backfill, compaction, restoring street surfaces, and clean-up.

4-02. **Shop Drawings.**

Wherever proposals for alternate methods or materials, special conditions, or the like, require approval of the District, detailed shop, fabrication, or erection drawings shall be provided by the Contractor. These drawings shall be submitted to the District for approval as specified in Section 1-20 to accommodate the rate of construction.

4-03. **Control of Water.**

The Contractor shall furnish, install, and operate all necessary machinery, appliances, and equipment to keep excavation sufficiently free from water during construction of the work to permit proper laying and jointing and shall dispose of water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public.

4-04. **Excavation.**

The Contractor shall perform all excavations for pipelines and appurtenances of whatever substances encountered to the depths indicated or otherwise required. Excavated material suitable for backfilling shall be piled in an orderly manner a minimum of two (2) feet from the excavated banks to avoid overloading and to prevent slides or cave-ins. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches. Any water accumulating therein shall be removed by pumping or other approved means. Such sheeting and shoring shall be installed as may be necessary for protection of the work and safety of personnel in accordance with O.S.H.A. requirements. Excavations in earth and in rock shall be carried to six (6) inches below bottom of pipe. Bell holes and depressions for couplings, valves, and the like shall be excavated the same distances below these installations. The materials excavated shall be used in the backfill or removed and disposed of by Contractor as required by Engineer and as specified.

The overnight use of trench plates will be allowed only upon written request by Contractor or Developer subject to approval by the District's General Manager. Trench plates shall be non-skid, a minimum of one-inch thick, and rated for H.D.-20 loading or greater. The excavation beneath the plate shall be shored, and the plates must be either pinned to the existing surface and ramped with temporary asphalt or counter-sunk flush to the surface. If two or more adjoining plates are to be used, they shall be tack-welded together. In the event that pending inclement weather or other conditions, as determined by the District, may adversely affect the use of plates, said plates shall be removed, and

the excavation shall be backfilled, and the surface secured with temporary asphalt. The placement of trench plates shall be in accordance with the requirements of and meet the approval of the governmental agencies having jurisdiction.

Unless otherwise approved by the District prior to the beginning of construction, the length of open trench shall not exceed 500 feet including excavation, pipeline installing, and backfill in any one location. Minimum trench width shall be as required for proper assembly and joint inspection, but in no case less than twelve (12) inches greater than nominal pipe diameter. Maximum allowable width of trench for all pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of all bells or collars) plus sixteen (16) inches, and such maximum shall be inclusive of all timbers. All open trenches will be backfilled to the satisfaction of the District Inspector by the end of each work day.

4-05. Location of Existing Facilities.

Contractor shall excavate and locate existing utilities and culverts prior to excavation. All pavement shall be cut or sawed a minimum eight (8) inches wider than the trench prior to trenching.

4-06. Depth of Pipe.

Unless otherwise shown on the plans, all water mains shall have a coverage of forty-two (42) inches between the top of the pipe and the top of curb.

4-07. Changes in Line and Grade.

The alignment of the pipeline is shown on the plans.

In the event obstructions not shown on the plans are encountered during the progress of the work, which will require alterations to the plans, the Developer's Engineer shall submit proposed changes to the District for approval. The Contractor shall not make any deviation from the specified line or grade without prior approval by the District.

4-08. Handling and Storing Materials.

During storage, handling, and transporting, every precaution shall be taken to prevent injury to pipe. Pipe shall be handled only by means of fabric slings or other approved methods for the pipe used.

Valves, fittings, hydrants, and other accessories shall be loaded and unloaded by lifting with hoist or skidding, so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Any disapproved materials shall be removed from the job site immediately.

In distributing the material at the site of work, each piece shall be unloaded opposite the place where it is to be laid in the trench.

Steel and ductile iron pipe shall be so handled that the lining and coating will not be damaged. If, however, any part of the coating is damaged, repair shall be made by the Contractor at his expense to manufacturer's specifications.

4-09. Installing Pipe.

The Contractor is required to coordinate all installation of the various utilities so that the storm drain, sewer and curb and gutter are constructed prior to the water main installation. The Contractor shall, after excavating the trench and preparing the proper bedding for the pipe, furnish all necessary facilities for properly lowering and placing sections of the pipe in the trench without damage and shall properly install the pipe. The sections of pipe shall be fitted together correctly and shall be laid true to line and grade in accordance with elevations established by the Engineer. In the absence of curb and gutter, construction stakes shall be set by a registered civil engineer or licensed land surveyor indicating line and grade and location of all valves and appurtenances. The maximum stake interval shall be fifty (50) feet. The full length of the barrel of the pipe shall have a uniform bearing upon six (6) inches of bedding material, but if the pipe has a projecting bell, suitable excavation shall be made to receive the bell which shall not bear on the subgrade. The requirement for closely fitting the bottom of the pipe to the bedding material for the width shown on the drawings will be strictly enforced.

Pipe shall be laid uphill. Pipe shall be true in alignment, both vertical and horizontal, and shall not show any undue settlement after laying. No pipe shall be laid which is damaged, cracked, checked, or spalled, or has any other defect deemed by the District to make it unacceptable. All such sections shall be permanently removed from the work.

At all times when the work of installing pipe is not in progress, all openings into the ends of the installed pipelines shall be kept tightly closed with suitable bulkheads to prevent the entrance of animals, foreign materials, and water.

The pipe trench shall be kept free from water at all times, and the Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, shall assume full responsibility for any damage due to this cause, and shall, at his expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating or due to any other reason.

All pipelines adjoining concrete structures shall have a flexible joint at eighteen (18) inches from the face of such concrete structures.

Before lowering and while suspended or standing vertically at trench side, the pipe shall be inspected for defects. Any defective, damaged, or unsound material shall be rejected.

a) Ductile Iron or Polyvinyl Chloride (PVC) Pipe.

Pipe shall be laid true to line and grade. Pipe shall be installed in accordance with AWWA C603. All pipe on curves shall be assembled straight and laid over. The maximum joint deflection shall be as hereinbefore specified. The rubber rings shall be checked after installation with a gauge supplied by the manufacturer to ensure that the ring is properly seated. If, for any reason, the ring is not properly seated, the joint shall be pulled apart and satisfactorily remade.

At all locations where pipe is to be encased or cradled in concrete, the pipe shall be wrapped with a minimum of two (2) layers of fifteen (15) pound, asphalt-impregnated roofing felt in such a manner that the concrete does not form a bond with the pipe.

Identification wire shall be installed with all non-metallic pipe. The wire shall be insulated, 14 gauge copper, and shall be installed as detailed on Standard Drawing No. W-8. The wire shall be placed on the top of the pipe and the centerline of the pipe. The wire shall be fastened securely at intervals of four (4) feet and at each joint or fitting with an eight (8) inch length of two (2) inch wide duct tape or other approved method.

Underground marking tape shall be installed with all non-metallic pipe. The tape shall be placed one (1) foot above the pipe with the lettering facing up. It shall be six (6) inches wide, blue in color, with the following wording: "Caution - Water Line Buried Below", stretchable, and constructed of six (6) ply high-density copolymer. The tape shall be Terra Tape Extra Stretch 540 or approved equal meeting the requirements listed above.

b) Steel Pipe.

Jointing sections of welded steel pipe with rubber gasket joints shall be accomplished by placing the rubber gasket in the spigot groove before the section is lowered into the trench and lubricating the bell end of the last section laid with an approved lubricant to reduce the friction of the entering gasket. The spigot end shall then be inserted in the bell end of the pipe in place and forced into position without injury to the pipe or gasket. Care shall be taken to ensure that the spigot is fully entered into the bell and a "feeler" gauge used to check the position of the rubber gasket. Just prior to joining the two ends together, each end of pipe shall be "buttered" with cement mortar in such a manner and in sufficient quantity to completely fill the space between the respective mortar linings. The mortar shall be composed of one (1) part of Portland Cement of the same type used in

the lining and coating, two (2) parts of sand by volume, and one-eighth (1/8) part fire clay with sufficient water added to give the mixture a stiff consistency. The mixture shall not be held over one (1) hour then shall be discarded and no re-tempering by addition of water shall be allowed. Epoxy concrete adhesive shall be applied to the metal prior to coating of field fabrications or minor repairs on both coating and lining that the District may allow. After the jointing is completed, the pipe interior shall be swabbed to remove all excess mortar by drawing an approved type swab or squeegee through the pipe. After the field joints have been completed and inspected, the joint exterior shall be thoroughly cleaned.

Pipe bonding devices to provide electrical continuity shall be installed in accordance with the pipe manufacturers recommendations.

The outside joint recess shall be grouted with cement mortar after a fabric diaper has first been placed around the joint and tightened securely to prevent leakage while the mortar is being poured. The diaper shall be made of heavy-duty polyethylene fabric or other approved material of sufficiently close weave to prevent cement loss from the mortar. The fabric shall be hemmed on each edge and shall contain a metal strap within each hem sufficiently longer than the circumference of the pipe to allow a secure attachment of the diaper to the pipe. The diaper shall be centered on the joint and positioned to provide a mortar coating of the pipe ends equal in thickness to the mortar coating on the pipe. The mortar shall be the same as for the interior joints except that it shall contain sufficient water to produce a creamy consistency. Prior to placing the mortar, the joint and diaper shall be moistened with water. The joints shall be poured and rodded or manipulated by hand to remove air bubbles from one side only until the mortar comes up to the top of the diaper on the opposite side. The mortar shall completely fill the outside annular space between the ends of the pipes around the entire circumference of the joint. If required by the District, the diaper shall be removed and the grouted joint inspected after the adjacent pipe sections have been sufficiently covered with backfill material to bring the pipe to a normal in-place temperature. The joint shall be repaired, if necessary, and given a heavy coating of Hunt, or equal, curing compound at the earliest practicable time after the mortar has hardened sufficiently.

Field welded joints shall be in conformance with AWWA C206.

4-10. Foundation Rock.

Where ground water is encountered or the native material does not afford a solid foundation for pipe subgrade as specified herein, the Contractor shall excavate to such depths below the subgrade as the District decides is necessary and shall construct a stable base by placing foundation rock upon which pipe bedding can be prepared. Foundation rock shall be three-quarter (3/4) inch aggregate base material.

4-11. Protective Coatings.

All otherwise uncoated buried steel surfaces, including nuts and bolts, shall be thoroughly coated with NO-OX Grease and then be wrapped with 8 mil polyethylene sheet per AWWA C-105.

4-12. Shop Painting.

All exposed ferrous metal surfaces, including any pipe supports, shall be shop painted unless otherwise shown on the plans.

a) Surface Preparation.

All rust, loose scale, and foreign matter shall be removed from surfaces to be coated by wire brushing or sandblasting. Oil and grease shall be removed with cleaning solvent, and surfaces shall be dry.

b) Coating.

Surfaces which will be in contact with the earth and are to receive a field applied coating as specified elsewhere shall be shop-painted in accordance with AWWA C203.

Exposed surfaces shall be shop-painted with one coat of red primer.

4-13. Anchor and Thrust Blocks.

Anchor and thrust blocks shall be installed at fittings and valves and, where directed by the District, in accordance with details shown on Standard Drawing W-4. Excavations and forms for thrust and anchor blocks shall be examined by the District's authorized representative prior to placement of concrete. Thrust blocks shall be constructed of five-sack concrete and shall bear against undisturbed soil and shall be allowed to cure until an adequate strength has been obtained, at least forty-eight (48) hours, prior to pressurizing the pipe. No quick setting additives shall be used. Any flanged fittings coming in contact with concrete shall be thoroughly wrapped, including the bolts and nuts, with a layer of 8 mil polyethylene film. Form work shall be constructed of sand bags wherever necessary to confine the concrete to the prescribed dimensions for the block.

4-14. Hydrostatic Tests.

After the pipe backfill has been completed and accepted, the pipe shall be subjected to a hydrostatic pressure test as hereinafter specified. The District shall be notified twenty-four (24) hours prior to testing. An Inspector shall be present.

Each water main shall be filled with potable water and shall be tested in sections of convenient lengths as determined by the range of elevations within the test section which shall result in test pressure within the limits hereinafter specified. Testing against valves will not be permitted.

The test pump and gauge shall be connected to the water main at a location other than the highest point in the line in order to facilitate release of air from the high point. The gauge shall be approved by the District.

The test pressure at the location of the testing equipment shall be computed on the basis of the relative elevations of the test gauge and the lowest point in the pipe section being tested and shall result in a pressure equal to the pressure classification of the pipe plus 50 psi at the lowest point in said pipe section. The test pressure at the highest point in the pipe test section shall not be less than 110 percent of pressure classification.

This test shall be made on all sections of water main in order that all pipe, valves, fittings, fire hydrants, connections, and water services may receive the test. The test pressure shall be maintained continuously by pumping for a period of one (1) hour. Pumping shall then be discontinued for one (1) hour and the drop in pressure read on the dial of the gauge at the end of the second hour and recorded. The initial test pressure shall then be restored by pumping, and the quantity of water pumped into the line to accomplish this shall be measured accurately. If there is any sign of leakage or failure at any point on the line during the test, the test shall be discontinued until the same has been repaired after which the test shall be repeated until the pipe section tested shall have met the above requirements. The test shall be performed and accepted only in the presence of District's authorized representative. The following table summarizes the maximum allowable leakage rate for various pipe materials:

PIPE MATERIAL	ALLOWABLE LEAKAGE (PER MILE, PER HOUR)
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STEEL (NON-WELDED)	$\frac{(D)\sqrt{T}}{36.75}$
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DUCTILE IRON & PVC	$\frac{(D)\sqrt{T}}{25.00}$
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D = DIAMETER IN INCHES

T = TEST PRESSURE (PSI)

Contractor shall furnish and install, at his own expense, all corporation stops, temporary pipe, fittings, connections, equipment, bulkheads, R.P.B.D.'s, and bracing required for the tests and shall be responsible for any and all damage resulting from failure under test of material furnished and installed by him, or from faulty workmanship, negligence, or improper test methods.

All defective joints, cracked, or defective pipe, fittings, valves, hydrants, or service connections shall be removed and replaced by Contractor with sound material. Tests shall be rejected until satisfactory results are obtained as determined by the District.

Before applying the specified test pressure, care shall be taken to insure the expulsion, through hydrants, air release valves, services, or by other suitable means, of all air within the pipe and appurtenances to be tested.

4-15. Disinfection of Water Mains and Services.

All water mains, water services, attached appurtenances, and temporary connections, if any, shall be disinfected in accordance with AWWA C601 and the following requirements:

Chlorine shall be applied to the water in sufficient quantity to produce a dosage of not less than 50 ppm in all sections of the line, services, and appurtenances. Treated water shall be retained in the system for a period of twenty-four (24) hours minimum and shall produce not less than twenty-five (25) ppm in all sections being disinfected at the end of the twenty-four (24) hour period. Chlorination shall be done using a chlorine gas/water or sodium hypochlorite solution. Chlorine dosage not-to-exceed one-hundred (100) ppm under normal conditions.

The chlorinated water may be used later, if practicable, for water settling operations in connection with backfilling, for testing other mains, or if not so used, Contractor will properly dechlorinate and dispose of the water. District will not be responsible for loss or damage resulting from such disposal.

Contractor shall install corporation valves in accordance with Standard Drawing W-1 of the proper size wherever necessary to chlorinate or sample and/or dispose of any chlorinated water. There shall be no separate payment for tapping and installing connections which are for filling, testing, sampling, or chlorination or flushing only.

Temporary taps for bacteriological samples shall be installed every 500 feet on main lines where there are no other outlets available for sampling.

Disinfecting the main and services, hydrostatic testing, and preliminary retention may run concurrently for the required twenty-four (24) hour period, but in the event there is leakage and repairs are necessary, additional disinfection may be required.

During the chlorination process, all valves and accessories shall be operated.

After the required period of retention of the chlorine or hypochlorite solution, a District representative will test the water for residual chlorine and any further tests which may be required.

After chlorination, the water shall be flushed from the line at its extreme ends until the replacement water is chemically and bacteriologically equal to the permanent source of water supply. One set of samples for bacterial analysis will be taken not less than twenty-four (24) hours later by the District and sent to the District's laboratory for analysis. The disinfection will not be considered complete until the supply is in conformance with the public health standards for drinking water and pseudomonas aeruginosa is no greater than the water source. The number of samples required will be as determined by the District, and the cost of processing will be borne by the Developer.

If the tests are not satisfactory, Developer shall provide additional disinfection as required at no extra cost to the District.

4-16. Water.

District will provide water at the standard metered rate to perform all necessary operations. No other water shall be used unless test results are provided proving the water meets all applicable quality standards at point of connection to system. Contractor shall bear the cost of any necessary testing and connections and install any necessary facilities to obtain water, unless stated on the drawings.

4-17. Excavation of Pipeline Trench.

a) Trench excavation shall be per Section 4-04.

b) Placing of Pipe Zone Bedding and Backfill Material.

All pipe zone backfill from a depth of six (6) inches below the bottom of the pipe to twelve (12) inches above the top of the pipe shall be imported fill sand having a minimum sand equivalency of SAE30. The six (6) inch bedding layer shall be placed and compacted to a minimum of 90% of the maximum density of the material at optimum moisture content. The pipe shall then be installed after which the remaining imported pipe zone material up to twelve (12) inches above the top of the pipe shall be placed and compacted in lifts, if necessary, to said relative compaction of 90%.

c) Backfilling Pipe Trenches Above the Pipe Zone.

Backfill in pipe trenches above the pipe zone shall be a structural fill accomplished by filling and compacting the trench in lifts of depths that will permit obtaining a minimum compaction of 90% of the maximum density of the material at optimum moisture content.

All backfill materials shall be placed in such a manner as to not disturb the pipe or damage its coating. Impact, free fall, hydro hammer, or similar compaction equipment shall not be used for compaction in water

system trenches. Slurry or cement-treated backfill material will not be allowed in trench with the exception of cross gutters, etc. as determined by the District Inspector or by written permission by the General Manager.

d) Trench Backfill Compaction Tests.

The Developer will retain the services of an independent soils firm having a State of California licensed laboratory to make soils compaction tests at any point or points or depths as the District sees fit after the trench is backfilled. The minimum number of tests shall be shown on the plans. In the event any of said tests indicate that the trench compaction is less than the compaction above described, the Contractor will be required, at his own expense, to remove placed trench material in the zone or zones directed by Palmdale Water District and to then replace and compact said trench material to meet the requirements of this specification. Re-tests will be required on re-compacted material. No compaction tests shall be spotted by the District until all utilities have been installed.

e) Trench Resurfacing.

Trench resurfacing, where required, shall be accomplished in accordance with the requirements of and meet the approval of the governmental agencies having jurisdiction. Within the boundaries of Palmdale Water District, such agencies will be the Los Angeles County Road Department, the City of Palmdale, or Caltrans.

f) Trench Width.

The trench width shall be the outside diameter of the pipe (exclusive of all bells or collars) plus sixteen (16) inches.

4-18. Valves.

All main line valves shall be located on the property line or utility easement prolongation in the street unless otherwise indicated by the District.

All valve box risers shall be of eight (8) inch Schedule 40 PVC pipe. All valve risers shall be adjusted so that the valve box lid will be flush with the finished street grade per Standard W-5.

Valves shall be installed plumb and in alignment with the pipe. Each valve shall be operated prior to its installation to assure proper functioning.

4-19. Fire Hydrants.

a) Location.

Hydrants shall be located as shown or as directed and in a manner to provide complete accessibility and also in such a manner that the

possibility of damage from vehicles or injury to pedestrians will be minimized. When placed behind the curb, the centerline of the hydrant barrel shall be set twenty-four (24) inches behind the face of curb unless specifically stated on approved plans.

The installation of the hydrants shall be in accordance with Standard Drawing No. W-2, W-2A, W-3, or W-3A.

b) Position.

All hydrants shall stand plumb and shall have their nozzles facing the curb at an angle of forty-five (45) degrees. Hydrants installed where there is no curb shall have the four (4) inch nozzle facing the street. Hydrants shall be set to the established grade as shown in Standard Drawings W-2, W-2A, W-3, or W-3A.

c) Fire Hydrant Barricades.

When required, fire hydrant barricades shall not obstruct the outlets and shall be constructed per Standard Drawing W-14 or W-15.

4-20. Connections to Existing Water Lines.

No connection to the existing system shall be made until after the new system has been completed and fully accepted by the District.

In the locations shown on the drawings, the Contractor shall cut and machine existing water pipes and install the new fittings and lines as specified or noted. The Contractor shall make all connections within a maximum shutdown period required by the District. If, in the opinion of the District, the connection cannot be accomplished within the required shutdown period, the connection shall be made at night or on weekends. The District will supervise operation of all existing valves necessary for the shutdown.

4-21. Hot Tapping of Existing Water Line.

Pressure taps are allowed only as shown on approved plans.

All hot taps shall either be performed by the District or an experienced licensed contractor specializing in said work. Contractors must have a proved ability to perform hot taps, hold a current underground contractor's license, and carry sufficient insurance as determined by the District and be approved by the District prior to commencing said work.

Existing mains to be tapped must be cleaned. The area required to be cleaned shall be either the diameter of the hot tap plus seven (7) inches or the full diameter of the main to be tapped when full circle reinforcement is required. The following steps are then required prior to hot tapping:

a) Steel Mains.

The nozzle shall be welded to the main after cleaning. It shall then be blind flanged and air tested to 100 psi. The pressure must hold for a minimum of three minutes. The test must be done in the presence of a District Inspector.

After passing the air test, the reinforcement ring shall be placed and welded continuously on edges to the existing main and to the nozzle pipe.

b) Ductile Iron and PVC Mains.

Mechanical tapping sleeves are required. After cleaning, the sleeve shall be bolted to the main and a blind flange placed on the nozzle. An air test shall then be performed as described above.

