

SECTION 14 SANITARY SEWERS

14.01 DESCRIPTION

This work shall include the furnishing of all the labor, materials, tools, equipment and incidentals to construct and complete in an efficient and workmanlike manner the installation of the sanitary sewer mains and laterals in accordance with the approved plans, standard details and these specifications.

14.02 MATERIALS

A. Gravity Sewer Pipe

1. Polyvinyl Chloride (PVC) Pipe and fittings shall, at a minimum, conform to the requirements of A.S.T.M. Designation D3034 as they apply to SDR-26 and SDR-35 PVC sewer pipe using an elastomeric gasket joint in a bell and spigot assembly system. PVC gravity sewer pipe and fittings shall conform to A.S.T.M. D3034 for diameters from inch through 15 inch and A.S.T.M. F679 for diameters from 18 inch through 24 inch. The City Engineer may require certification by the manufacturer that the test results comply with specification requirements. The pipe shall have a home mark to indicate full penetration of the spigot when a joint is made. The date of manufacture shall be marked on the pipe. Pipe being installed shall have been manufactured within 12 months of the date of installation.
2. Acrylonitrile-Butadiene-Styrene (ABS) composite pipe and fittings shall conform to and meet the requirements of ASTM Designation D2680, Standard Specification for ABS composite sewer pipe in sizes 4" inches through 15" inches. Each lot of pipe and fittings shall be inspected for defects and tested in accordance with ASTM D2680. The City Engineer may require certification by the manufacturer that the test results comply with specification requirements. The pipe shall have a home mark to indicate full penetration of the spigot when a joint is made. The date of manufacture shall be marked on the pipe. Pipe being installed shall have been manufactured within 12 months of the date of installation. Unless otherwise specified by the City Engineer, all composite pipe shall be furnished in standard 20-ft. lengths. Trench width for ABS composite shall be pipe O.D. plus 24 inches, as measured at the top of the pipe.
3. Ductile Iron Pipe and fittings shall conform to the requirements of ANSI/AWWA C151/A21.51 and shall have a minimum 40 mil polyurethane lining and 8-mil polyethylene encasement.
4. All other gravity sewer pipe shall require special approval from the City Engineer.

B. Pressure Sewer Pipe

Whenever the design of a sanitary sewer system includes the necessity of a sewage lift station and/or pressure mains, types of pipe shall be approved by the City Engineer for each specific case. If ductile iron is used, the minimum class of pipe and fittings shall be Pressure Class 350.

C. Joints and Couplings

1. Polyvinyl Chloride Joints shall be bell and spigot using an elastomeric gasket, which meets the requirements of ASTM Designation F477. Connections to manholes, or other concrete structures shall be made by utilizing manhole adaptors or elastomeric seal rings embedded in the concrete.
2. Banded rubber couplings shall conform to the requirements of ASTM Designation C-425, and shall have a stainless steel shear band.
3. Joints for ABS composite pipe shall be Type SC, solvent cemented per ASTM D2680. Prior to assemblage of the pipe joints, the exposed cross sectional ends of composite pipe shall be coated with the same solvent cement used for jointing the pipe. Manhole connections shall incorporate an approved steel band and rubber gasket waterstop, or steel bands and rubber boot, which allows the pipe to deflect while maintaining a watertight connection between pipe and manhole. Alternative methods of providing a flexible watertight connection shall require special approval from the City Engineer.

D. Fittings

All fittings shall be manufactured of the same materials as the pipe and installed in accordance with the Standard Details.

E. Laterals

1. Sanitary sewer pipe laterals shall be of the same material type and designation as that used for the main sanitary sewer pipe. The use of four (4) inch diameter SDR-35 PVC sewer pipe and fittings will not be permitted. Four (4) inch diameter SDR-26 PVC sewer pipes and fittings shall be used for laterals for both SDR-26 and SDR-35 PVC sewer mains.
2. Joints and Couplings for laterals shall be of the same type and specifications as those used for the main except that four (4) inch diameter SDR-35 PVC sewer pipe will not be permitted.

F. Manholes

Sanitary sewer manholes shall be Class A concrete cast-in-place or precast reinforced concrete conforming to ASTM Designation C-478. Manholes shall be constructed in accordance with the Standard Details.

Iron castings for manhole covers and frames shall conform to ASTM Designation A-48, Class 35 and be of the dimensions shown on the Standard Details.

The country of origin shall be clearly and permanently shown on the top surface of the frame and cover in accordance with the Trade and Tariff Act of 1984. Date of manufacture shall be clearly and permanently indicated on the cover and the top of the frame.

The weight of the frame shall be 140 lbs. +/- 10 lbs. The weight of the cover shall be 130 lbs. +/- 5 lbs.

All castings shall be sound and free from shrinkage cracks, blow holes, and other defects. All fins and burnt sand shall be removed. Excessive porosity and spongy surfaces will constitute causes for rejection. The City Engineer shall be the judge as to whether the defects are sufficient to cause rejection.

The manhole cover shall seat evenly and firmly in the frame. Seating surface shall be closely machined to nominal dimensions with tolerances not to exceed +/- 1/64 inch. Cast iron frames and covers shall be dipped or painted with asphalt which will form a tough, tenacious, non-scaling coating which does not have a tendency to become brittle when cold or sticky when hot.

G. Manhole Lining

The contractor shall line the interior of new manholes located on trunk lines 10" inches or greater in diameter as required in Division I. Section 5.03. The lining system shall consist of etching, prime coats and finish coats. The lining options are as follows:

1. Coal Tar Epoxy

- A. Surface: Concrete submerged or subject to moisture.
- B. Surface Preparation: Concrete surface shall be etched and rinsed clean prior to painting.
- C. Coatings: Primer – as recommended by manufacturer.
- D. Finish – two coats – Koppers 300M, Tnemec 46H-413 or equal.
- E. Dry Film Thickness – 16-mil total.

2. Epoxy

- A. Surface: Concrete submerged or subject to moisture.
- B. Surface Preparation: Concrete surface shall be etched and rinsed clean prior to painting.
- C. Coatings: Primer – one coat – Sikagard 693, Concesive 1170, or equal.
- D. Finish – one coat – Sikagard 692, Concesive 1170, or equal.
- E. Dry Film Thickness – 16-mil total.

H. Cleanouts

Sanitary sewer cleanouts shall be located and constructed in accordance with the Standard Details.

14.03 INSTALLATION

A. Sanitary Sewer Installations

All sanitary sewer pipe installations shall be accomplished as specified herein except where modified by the requirements specific to the various types of pipeline materials specified under Section 02.

Tracer wire shall be installed for all non-ferrous pressure sewer mains and for other gravity mains as determined by the City Engineer.

All sewer pipe shall be laid with a minimum of 12 inches vertical clearance from water and 6 inches clearance from all other improvements and utilities, unless otherwise approved by the City Engineer. Refer to the pipe cover requirements in Section 5 of the Design Standards for minimum cover

requirements. All pipe shall be laid to conform to the prescribed line and grade as shown on the plans and each pipe length checked to the grade line, which the Contractor establishes from the grade stakes.

The grade line shall be established before any pipe is laid in the trench. For pipes with slopes greater than 1%, the string line set for trenching purposes may be used as the grade line. For pipes with slopes less than 1%, a grade line shall be established in the bottom of the trench such that the top of each bell will touch the line when the pipe has been properly positioned.

Alternate use of commercial LASER grade setting in lieu of string lines specified herein are acceptable when the following requirements and conditions are met:

1. The Contractor shall have the responsibility of providing an instrument operator who is qualified and trained in the operation of the LASER and said operator must adhere to the provisions of the State of California Construction Safety Orders issued by the Division of Industrial Safety. Attention is particularly directed to Sections 1516, 1800, and 1801 of said Orders for applicable requirements.
2. All LASER control points shall be established bench marks or construction off-set stakes identified on cut sheets and set in the field for the work. LASER set up points shall be these control points or points set directly from them by instrument.

Each length of pipe shall be laid on compacted, approved bedding material as specified and shall have full bearing for its entire length between bell holes excavated in said bedding material to allow for unobstructed assembly of all bell and spigot joints. "Swinging In", or "Popping On" spigot ends of pipe into bell ends will not be permitted. After jointing is accomplished, all annular spaces between pipe and bell holes shall be packed with bedding material, taking care not to damage, move or lift the pipe from its bedding support.

Adjustments of pipe to line and grade shall be made by scraping away or filling in and tamping approved material under the body of the pipe. No wedging or blocking to support the pipe will be permitted.

A sewer line, unless otherwise approved by the City Engineer, shall be laid, without break, upgrade from point of connection to existing sewer and with the bell end forward or upgrade. When pipe laying is not in progress, the forward end of the pipe shall be kept effectively closed with an approved temporary plug or cap.

Sewer pipes, laterals, stubs, or other open ends, which are not to be immediately connected, shall be plugged or capped with a standard manufactured watertight plug or cap, suitable for use on the type of pipe. The plug or cap shall be placed on a standard end.

Pipe entering or leaving manholes or other structures shall have joints within 2-1/2 feet of the manhole base.

In all cases, flexibility of joints in or at the manhole base shall be preserved to prevent damage to the pipe by differential settlement.

All sewer line connections to manholes, trunk sewers, main sewers, or side sewers shall be left uncovered until after the inspection has been made. After approval of the connection, the trench shall be backfilled as specified. The City Engineer may, at his discretion, require special pipe to be laid in areas that are potentially unstable or subject to settlement.

If the sewer is to be laid in an area that is to be filled, and the cover prior to filling is less than five (5) feet, the pipe shall not be laid until the area has been filled to a level five (5) feet above the proposed pipe and compacted to 90% relative compaction, unless otherwise authorized by the City Engineer.

When a new sewer is extended from other than an existing manhole and the first new manhole upstream of the connection established conditions prescribed in Section 5.03.F6 of the Design Standards, the Contractor installing such new facilities shall also be responsible for installing backflow prevention devices in conformance with said section on existing side sewers so affected.

B. Laterals

Attention is directed to the Standard Details for additional details and requirements pertinent to lateral installations.

The use of saddles on the sanitary sewer main for sanitary sewer lateral connections will not be permitted.

That portion of any lateral line to be placed under an existing concrete curb and gutter and/or sidewalk shall be done by boring or cutting and replacing the existing concrete curb and gutter and/or sidewalk.

Where applicable, a two (2) inch x two (2) inch letter "S" shall be stamped, chiseled, cut, etc. on the top of all concrete curbs on all sanitary sewer laterals directly above the location where the lateral crosses the flow line of the gutter.

The lateral line shall have a clean-out at back edge of sidewalk as shown on Standard Detail No. 401. Laterals and cleanouts shall not be located in driveways unless approved otherwise by the City Engineer.

When a backflow prevention device is required under Section 5 of the Design Standards, such installations shall be made after final grading around the building has been completed and at a location where sewage can overflow without serious property damage on adjacent areas. It shall be the responsibility of the Contractor installing backflow prevention devices to see that informational notices, for present and future owners, regarding the importance of such devices are conspicuously posted upon the device and on the structure by said device.

C. Manholes

Precast Manhole Construction - All precast manholes shall be excavated, and backfilled in conformance with the requirements of Section 19-3 of the State Standard Specifications and installed as specified herein. All embedment materials under, around and at least 6 inches over all pipelines located within five (5) feet of structure bases shall be compacted without jetting prior to

barrel section placements. All precast manholes shall be constructed to subgrade prior to placement of structure backfill.

All joint surfaces of precast sections and face of manhole base shall be thoroughly cleaned prior to setting precast sections. Precast manhole sections shall be sealed with a joint sealer. The joint sealer shall meet the requirements of Federal Specification SS-S-00210 and shall be Ram-Nekby K.T. Snyder Company, Inc., Kent Seal, Conseal, Gulfseal, or approved equal.

1. Installation of gaskets - Apply primer per mfg's recommendation to clean, dry joint surface (both tongue and groove) and allow to dry. Remove the paper wrapper from one side only of the two-piece wrapper on the gasket. The outside paper will protect the gasket and assure against stretching. Before setting the manhole section in the trench, attach the plastic gasket strips end-to-end to the tongue and groove of each joint, forming a continuous gasket around the entire circumference of the manhole joint.
2. Handling of barrel sections after the plastic gasket has been affixed shall be carefully controlled to avoid bumping the gasket and thus displacing it or contaminating it with dirt or other foreign material. Any gaskets so disturbed shall be removed and replaced if damaged and repositioned if displaced.
3. Care shall be taken to properly align the manhole section with the previously set section before it is lowered into position.
4. During cold or wet weather, pass direct heat over the concrete joint surface lightly until ice, frost and moisture are removed and surface to be primed is dry and warm immediately before application of primer. Direct heat shall also be passed over plastic gasket strips immediately prior to attaching them to joint surfaces and immediately prior to insertion of tongue into groove.

The cast-in-place concrete base shall be Class A concrete. It shall rest on a minimum of 6 inches of bedding material, and shall be of the dimensions shown on the Standard Details.

If vertical and horizontal alignment of sewer lines are consistent through manholes, the pipe may be laid continuously through the manhole location. After the manhole base and precast sections have been placed and sufficient time has elapsed to allow all concrete and grout to set, the top half of the pipe within the manhole shall be carefully cut off and the sides mortared. All channels so formed shall be checked with a template and shall form a smooth flowing channel at all flow depths.

Temporary covers of 3/8 inch steel plate of sufficient size to adequately cover the opening shall be placed on the cone until the street structural section is complete. The manhole casting shall then be installed. Suitably located ribs shall be welded to the underside of the cover to hold it in place during any grading operations.

The throat of the manhole shall be made of precast concrete rings of the proper inside diameter. The maximum depth permitted shall be 12" inches of rings between the cone and the top of the frame.

When adjusting the manhole frame and cover to grade, the frame shall be wired to a 2" inches x 4" inches of sufficient length to span the excavation and the throat completed to the right level. Whenever the space between the bottom of the frame and the top of a ring is less than three inches, the void may be filled with concrete, poured against a suitable form on the inside of the structure.

When adjusting an existing manhole to grade and the total depth of the throat from the top of the frame to the bottom of the throat exceeds 18 inches, the upper portion of the manhole shall be removed to the first full-size manhole section. The upper portion shall then be reconstructed as outlined above.

When connecting to an existing manhole, first cut out an opening in the wall of the manhole. Insert the end of the pipe through the opening. The end of the pipe shall be fitted with an elastometric coupling with a steel band and a rubber gasket water stop. The opening around the pipe shall then be packed with a stiff mix of thoroughly compacted cement mortar composed of one (1) part type II Portland Cement and three (3) parts clean sand. Connections shall be checked for water tightness.

Before any work is started on adjusting or repairing a manhole, the channels in the base shall be covered with strips of wood and the entire base covered with a heavy piece of canvas. This cover shall be kept in place during all work. Upon completion of the work, the wood strips and the canvas shall be removed from the manhole allowing no debris to fall in or remain in the manhole.

Eccentric manholes shall be constructed perpendicular to flow unless otherwise directed by the City Engineer.

Sanitary sewer manholes shall be subject to a vacuum test as noted in Section 4.01 below, prior to approval.

D. Testing of Sewer Lines

All leakage tests shall be completed and approved after City acceptance of street subgrade and/or trench backfill except for the manhole vacuum test. Any excavation required for testing or repairs shall be backfilled with aggregate base compacted to 95% relative compaction.

1. All sewer manholes shall pass a vacuum test. The vacuum test shall be performed by the Contractor after installation of the manhole but prior to placement of trench backfill. All joint surfaces both inside and outside of the manhole shall be plastered with mortar and all lift holes shall be filled with mortar. All pipes entering the manhole shall be plugged, taking care to securely brace the plug to prevent it from being drawn into the manhole. The test head shall be placed inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. Acceptable times are:

45+ seconds for 36 inch manhole
60+ seconds for 48 inch manhole
75+ seconds for 60 inch manhole
90+ seconds for 72 inch manhole

If a manhole fails the vacuum test, repairs shall be made with mortar while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

All joint surfaces of precast sections and the manhole base shall be plastered with mortar both inside and outside of the manholes. All joint surfaces plastered with mortar shall be brushed to a smooth finish with a wet brush. The mortar shall be composed of one (1) part Type II Portland cement and three (3) parts clean sand. All manholes shall be watertight.

2. Cleaning and Flushing

Cleaning and flushing for acceptance shall occur after all manholes and cleanouts have been raised to grade and finished unless approved otherwise by the City Engineer. Cleaning shall be performed by the Contractor by means of an inflatable rubber ball. The ball shall be of a size that will fit snugly into the pipe to be flushed. The ball shall be placed in the last cleanout or manhole of the pipe to be cleaned, and water introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. If any wedged debris or damaged pipe stop the ball, the Contractor shall remove the obstruction. When a new sewer is connected to an existing line, cleaning and flushing shall be carried out to the first existing manhole downstream from the point of connection. A screen of ¼ inch mesh shall be used to ensure that no debris enters the existing system.

3. PVC Deflection Test

A deflection test shall be made by the Contractor after the PVC sewer pipe is installed and cleaned and upon completion and acceptance of all trench backfill by the City. The deflection testing shall be in the presence of the City Engineer and shall be conducted by the Contractor. One hundred percent (100%) of all mainline PVC sewer pipe installed shall be deflection tested for excessive vertical deflection using a pre-sized, rigid mandrel or "Go-No-Go" device approved by the City Engineer. The mandrel size shall be clearly labeled and shall be sized so as to provide a diameter of at least (95%) of the base internal diameter as specified in ASTM D-3034 for PVC gravity sewer pipe.

The mandrel shall be drawn through the pipe using only the force that can be exerted by one man on the end of a rope, using no mechanical advantage. Under no circumstances shall the mandrel device be attached to the cleaning ball.

Pipe exceeding five percent (5%) deflection shall be repaired or replaced and shall be remandrelled in the presence of the City Engineer. Re-rounding or other attempts to reduce deflection beyond the allowable limit will not be acceptable. All retests for deflections shall be made at the complete expense of the Contractor.

4. Low-Pressure Air Test

After City acceptance of street subgrade and/or the trench backfill, the Contractor shall, at his expense, conduct a Line Acceptance Test using low-pressure air. The test shall be performed according to stated procedures in the presence of the City Engineer.

PROCEDURE: At least two minutes shall be allowed for the air pressure to stabilize after air is introduced into the sealed test section.

After the stabilization period (3.5 psi minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psi is not less than the time shown for the given diameters in the following table:

<u>Pipe Diameter in Inches</u>	<u>Minutes</u>
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0

If the installation fails to meet this requirement, the Contractor shall, at his own expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship and perform the air test as many times as necessary to achieve an acceptable test. All repairs and/or replacements and retests shall be at the Contractor's expense.

The pressure gauge used shall be supplied by the Contractor and shall have minimum division of 0.10 psi, and shall have an accuracy to 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm.

SAFETY: The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. No one shall be allowed in the manholes during testing. Plugs shall not be removed until all air pressure is completely relieved.

5. T.V. Inspection

Prior to acceptance of any sanitary sewer line by the City, all six-inch and larger lines shall be inspected internally by television as outlined below at the Contractor's expense.

Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected by the Contractor, at his expense. For joint separations, low spots and chipped ends, the following maximum acceptable limits shall apply.

Joint separations - 1/2 inch

Low spots - $\frac{3}{4}$ inch maximum depth for pipes less than or equal to 12 inches in diameter; 1 inch maximum depth for pipes greater than 12 inches in diameter

Chipped ends - $\frac{1}{4}$ inch

- A. The complete job is ready for television inspection when the following work has been completed:
 1. All sewer pipelines are installed and backfilled.
 2. All structures are in place, all channeling is complete and pipelines are accessible from structures.
 3. All other underground facilities, utility piping and conduits are installed.
 4. Final street subgrade and/or trench backfill is complete and ready for asphaltic concrete paving.
 5. Pipelines to be inspected have been preliminary balled and flushed or cleaned with a high pressure cleaner.
 6. Final air test has been completed and approved.
- B. When the above work is complete, the Contractor shall arrange for the television inspection.
- C. The Contractor shall notify the City Engineer in writing 24 hours prior to the scheduled date of the television inspection.
- D. After conditions 1 thru 6 as outlined in "A" above are met, the entire job will be initially televised and videotaped in the presence of the City Engineer. Water shall be introduced into the pipeline as approved by the City Engineer. The tapes and reports shall be delivered to the City Engineer immediately after completion of the television inspection.
- E. Videotapes will be 1/2-inch VHS format magnetic tape and the audio and video portions will be free of electrical interference and excessive background noise.
- F. The audio report shall be recorded by the operating technician on the videotapes as they are being produced and shall include the location of the sewer, the names and numbers of the manholes involved, the direction of travel and a description of all lateral locations and conditions in the sewer line as they are encountered.
- G. In addition to the audio report, a written report shall be required listing all the information required in the audio report.
- H. The Contractor will be notified in writing by the City Engineer of any deficiencies revealed by the television inspection that will require repair. If corrective work is indicated and the Contractor wishes to view videotapes, he shall contact the City Engineer to set a time for viewing with the City Engineer.
- I. Corrective work shall be done by the Contractor at his expense.
- J. Those portions of the pipeline system that have been corrected shall be re-televised and videotaped at the Contractor's expense and the tapes and reports delivered to the City Engineer.
- K. The procedure outlined in conditions "A" thru "G" above will be repeated until all deficiencies observed by television inspection have been corrected to the complete satisfaction of the City Engineer.

- L. All videotapes and reports shall become the property of the City.
- 6. Final Visual Inspection

A final visual inspection will be made by the City Engineer to ensure that there is no ground water intrusion into the sanitary sewer system. If ground water intrusion is discovered by the City Engineer, corrective work shall be performed by the Contractor at his expense.
- 7. Connection to Existing Sanitary Sewer Systems

Temporary plugs, brick, mortar, or other approved devices shall be installed on all sewer projects at points of connection to existing facilities. The plugs shall remain in place until completion of the testing as covered in Section 14.03D of these Specifications. These plugs, intended to prevent water and/or debris from the balling and flushing operation, drainage, or any other condition from entering the existing system, shall be installed and removed in the presence of the City Engineer. The system shall be cleaned prior to plug removal.

14.04 MEASUREMENT AND PAYMENT

A. Pipe

Payment for sanitary sewer pipe complete in place shall be per linear foot measured from center of manhole to center of manhole following a line parallel to the grade of the sewer. Payment will include the furnishing of all labor, materials, water, tools, and equipment required to construct, test and complete the installation of the sewer pipe in accordance with the plans and these specifications.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.

B. Structures & Manholes

The unit of measure for payment shall be per each unit. Payment shall be made at the bid price per item for each structure complete in place and shall include but not be limited to the cost of excavation, backfill, frames, covers, plates, or reinforcing steel where required.

Full compensation for all incidentals arising from this work shall be considered as included in the price paid per unit of measure and no further compensation shall be allowed.