

The following standard specification is intended to be edited according to the specifics of the project. Brackets [] and areas shaded in gray [e.g. format] indicate requirements that are optional depending upon the type of system being provided or per instructions associated with the [] and project requirements. Consult with University's Representative and campus stakeholders.

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SECTION 33 31 00 SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sanitary sewer piping, material, fittings, and accessories for gravity lines.
- B. Connection of site sanitary sewer system to existing sanitary sewer system.

1.2 RELATED SECTIONS

- A. Section 01 33 23 Shop Drawings, Product Data and Samples
- B. Section 01 43 00 Quality Assurance
- C. Section 01 57 23 Storm Water Pollution Prevention
- D. Section 09 99 00 Painting and Coating
- E. Section 31 23 33 Trenching and Backfilling
- F. Section 33 05 26 Utility Signs, Markers, and Flags
- G. Section 33 08 30 Commissioning of Sanitary Sewer Utilities
- H. Section 33 39 23 Sanitary Sewerage Cleanouts

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM) D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
- B. ASTM D2241 - Standard Specification for PolyVinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
- C. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- D. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- E. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- F. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- G. American Water Works Association (AWWA) C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems
- H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- I. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water
- J. AWWA C153/A21.53 - Ductile-Iron Compact Fittings for Water Service
- K. "Greenbook" Standard Specifications for Public Works Construction, 2006 Edition
- L. State of California, Department of Health Services, "Criteria for the Separation of Water and Sanitary Sewer."

M. UPC, Uniform Plumbing Code, current edition

1.4 SUBMITTALS

- A. See Section 01 33 23 Shop Drawings, Product Data and Samples for submittal procedures.
- B. Product Data: Provide data acknowledging that products meet requirements of standard referenced.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, manholes and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 - PRODUCTS

2.1 PVC PIPE, PIPING 12 INCHES AND UNDER

- A. Pipe: PVC pipe shall be bell-and-spigot type conforming to ASTM D3034, Type PSM, SDR 35 of materials specified in ASTM D1784, Class 12454 or 12364. Bells shall be integral with pipe. Spigot end pipe with separate double hub couplings is not acceptable. Type PSM, SDR 26 PVC pipe and fittings conforming to ASTM D3034 shall be utilized for piping larger than 12 inches in diameter, piping installed deeper than 15 feet, or piping installed in close proximity to domestic water lines as specified in **Section 33 31 00, Part 3.1K. High-Density Polyethylene (HDPE)** is not an acceptable product and will not be considered for product substitution.
- B. Joints: Joints shall be PVC specified in ASTM D3212, elastomeric joints using elastomeric seals complying with ASTM F477.
- C. Fittings: SDR 35 PVC conforming D3034 for PSM type, ASTM D2241, and ASTM D1784, Class 12454 or 12364. The strength class of fittings shall no be less than the strength class of any adjoining pipe.

2.2 DUCTILE IRON PIPE

- A. Pipe: DIP pipe shall be Class 50 AWWA C151 with hub and spigot ends. Pipe shall be furnished in minimum standard lengths of 20 feet.
- B. Joints: DIP with elastomeric rubber ring joints conforming to AWWA C111 for push-on or mechanical joints
- C. Fittings: Fittings shall be ductile iron pipe conforming to AWWA C153, size 3 through 24 inch, and AWWA C110 greater than 24 inch, and shall be 350 psi working pressure rated. Couplings, sleeves, and accessories shall be manufactured by U.S. Pipe TrimTyte, Union Foundry, Tyler; or equal.

Note to specifier: coordinate requirement of DIP lining with University's Representative in cases where high velocities, corrosion and/or high hydrogen sulfide is a potential concern and insert the following text.

- D. Pipe Lining: DIP pipe and fittings shall be ceramic epoxy lined with PROTECTO 401 Ceramic Epoxy or equal. Pipe to be epoxy lined shall be delivered to the coating application facility without asphalt, cement lining, or any other lining on the interior surface. DIP with previously removed lining shall not be permitted for installation.

1. The interior of the pipe shall receive 40 mils nominal dry film thickness of ceramic epoxy. Surface Preparation and lining application shall be in accordance with the coating manufacturer's recommendations.
2. Touch-up and repair shall be performed in accordance with the coating manufacturer's recommendations.
3. Inspection and certification by coating manufacturer:
 - a. All DIP pipe and fittings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.
 - b. The interior of the lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2500 volt test. Any defects found shall be repaired prior to shipment.
 - c. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of applicator's work.
 - d. The pipe or fitting manufacturer shall supply a certificate attesting that the applicator met the requirements of this specification, and that the material used was as specified.
4. Ceramic epoxy lined pipe and fittings shall be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling. Care shall be taken not to let the pipe strike sharp objects while swinging or being offloaded. DIP shall not be placed on grade by use of hydraulic pressure from an excavator bucket or by force with heavy hammers.

Note to specifier: if high velocities, corrosion and/or hydrogen sulfide is not a concern and if approved by the University's Representative, insert the following text:

- E. Pipe Lining: Interior of DIP pipe and fittings shall be lined with cement mortar in accordance with AWWA C104. Cement shall be ASTM C150, Type II or V, low alkali, containing less than 0.60 percent alkalis.

2.3 ACCESSORIES

- A. Cleanouts shall be as indicated on the Drawings and as specified in [Section 33 39 23 Sanitary Sewerage Cleanouts](#).
- B. Line Marker shall be as specified in [Section 33 05 26 Utility Line Signs, Markers, and Flags](#).
- C. All ductile iron pipe and fittings shall be wrapped in polyethylene per AWWA C105.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Have on hand all installation manuals, brochures, and procedures for the equipment and materials concerned.
- B. Follow manufacturer instructions, where such are provided, in all cases that cover points not shown on the Drawings or specified herein. Manufacturer's instructions do not take precedence over the Drawings and Specifications. Where manufacturer's instructions are in conflict with the Drawings and Specification, submit the conflicting instructions to the University's Representative for clarification before performing the work.
- C. Minimum cover over pipe shall be 3 feet from top of pipe to finished grade, unless otherwise noted.

Note To Specifier: Coordinate with [Section 31 23 33](#).

- D. Bedding and cover shall be as specified in **Section 31 23 33 Trenching and Backfilling**.
- E. Hand trim excavation for accurate placement of pipe to elevations indicated.
- F. Immediately before placing pipe in final position and joining, check bedding for confirmation to specification requirements. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.
- G. Pipe and accessories shall be inspected for defects prior to lowering into trench. Any defective, damaged, or unsound pipe shall be replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Install PVC pipe, fittings, and accessories in accordance with ASTM D2321 and manufacturer's instructions.
- H. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet. The slope shall be smooth.
- I. Install continuous line marker above top of pipe as specified in **Section 33 05 26, Utility Line Signs, Markers and Flags**.
- J. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.
- K. Maintain proper separation between potable water lines as specified in the State of California, Department of Public Health, "Criteria for the Separation of Water and Sanitary Sewer."
- L. Do not lower any pipe or fitting into a trench that contains water. Pump water from wet trenches, and keep the trenches dry until the joints have been completed and the open ends of the pipes have been closed with watertight plugs or bulkheads. Do not remove the plug or bulkhead unless the trench is dry.
- M. Installation shall comply with requirements of Section 01 57 23 Storm Water Pollution Prevention.
- N. Each pipe-compression-type joint shall be joined with a lock-in rubber ring and a ring groove that is designed to resist displacement during pipe insertion. The ring and the ring seat inside the bell shall be wiped clean before the gasket is inserted. At this time, a thin film of lubricant shall be applied to the exposed surface of the ring and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall then be forced into the ring to complete the joint. The pipe shall not be deflected either vertically or horizontally in excess of the printed recommendations of the manufacturer of the coupling.

3.2 CONNECTIONS TO EXISTING SEWER MAIN

- A. Utility interruption shall be in accordance with Section 01 14 00 Work Restrictions.
- B. Where laterals are the same size as the main, connection must be made with a manhole. Use a wye for all other lateral connections except for lateral connections to existing mains 12 inches and larger.

Note to specifier: for lateral connections to existing mains 12 inches and larger, coordinate use of taps and saddles per University Standard Detail SS-04. Coordinate usage with Drawings

- C. For lateral connections to existing mains 12 inches and larger, use taps and saddles per details.
- D. Take care while making tap connections to prevent concrete or debris from entering existing pipe or structure. Remove debris, concrete, or other extraneous material, which may accumulate.

3.3 CLEANING AND FLUSHING

- A. All sewer lines shall be tested for obstructions and cleaned by a method that shall be approved by the University's Representative. Clean interior of pipe by flushing if required to remove collected debris. Any obstructions or irregularities shall be removed or repaired by the Contractor. All testing, cleaning, and repairing shall be done to the satisfaction of the University's Representative. The

Contractor shall dispose of all waste, including water, at no additional expense to University. The water shall not be allowed to enter existing storm drain or sanitary sewer systems without the prior approval of the University's Representative.

- B. The entire piping system shall be thoroughly flushed out until acceptance of the University's Representative. All tests shall be conducted at such times as directed by and in the presence of the University's Representative.
- C. For piping greater than 6 inches and any main piping, clean pipe shall be tested by propelling a snug fitting inflated rubber ball through the pipe with water to remove any debris.
- D. For piping 6 inches and smaller, flush piping applying full size pipe flushing.

3.4 TESTING

- A. Leak Testing: Testing shall be performed after completion of all underground work and shall be successfully completed prior to commissioning (placing in service) any portion of the sewer system. The program of testing must fit the condition as mutually determined by the University's Representative and the Contractor. The Contractor shall take all necessary precautions to prevent any joints from drawing while the pipelines or their appurtenances are being tested. Contractor shall, at no additional cost to University, correct any excess leakage and repair any damage to the pipe and its appurtenances or to any structure indicated by or resulting from these tests.
 - 1. Water exfiltration testing shall be conducted between two consecutive manholes. The lower end of the pipe to be tested shall be plugged as well as the inlet sewer of the upper manhole.
 - 2. The hydrostatic head for test purposes shall be at least 4 feet above the water table and crown of pipe at the upstream manhole. In every case, the height of the water table at the time of the test shall be determined by exploratory holes or such other methods approved by the University's Representative. The University's Representative shall make the final decisions regarding test height for the water in the pipe section being tested. The length of pipe tested by exfiltration shall be limited so that the pressure on the invert of the lower end of the section shall not exceed 20-feet of water column.
 - 3. Pipe and joints shall sustain a maximum leakage limit of 250 gallons per inch pipe diameter per mile per 24 hours, as measured over a period of 30 minutes minimum.
 - 4. All sewer lateral connection footage included in the test section and subjected to minimum head specified shall be taken into account in computing allowable leakage.
 - 5. Dispose of test water in a manner that will not damage or interfere with adjacent property and in a manner acceptable with the University's Representative and all regulatory agencies.
 - 6. Even though the test for leakage is within the prescribed limits, the Contractor shall repair any obvious leaks.
 - 7. Manholes are tested separately as specified in **Section 33 05 13, Manholes and Structures**.
- B. Low pressure air testing may be used in lieu of water exfiltration testing for pipelines 12 inches in diameter and smaller when approved in advance by the University's Representative. The following procedure shall be used for air testing:
 - 1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
 - 2. If the pipe to be tested is submerged in ground water, insert a pipe probe, by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.

3. Add air slowly to the portion of the pipe installation under test until the internal pressure is raised to 5.0 psig.
 4. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any leakage is observed, bleed off air and make necessary repairs.
 5. After an internal pressure of 5.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
 6. After the two minute period, disconnect the air supply and start stopwatch. The pressure of 5.0 psig shall be maintained for 5 minutes.
 7. As an alternative, the Contractor may request the air testing procedure as presented in Section 306-1.4.4 of the 2006 edition of the "Greenbook" Standard Specifications.
 8. Adjust air pressure requirements if ground water table is above the sewer line being tested. An increase of 0.433 psi for each foot the ground water level is above the invert of the pipe shall be applied.
- C. Deflection Testing shall be conducted by the Contractor for PVC SDR 35 pipe 6 inches in diameter and larger. Deflection testing is not required for PVC SDR 26 or DIP piping.
1. After pipe installation and not less than 30 days after completion of the trench backfill, but prior to placement of pavement, PVC SDR 35 pipe shall be cleaned and mandrel tested for obstructions such as, but not limited to, deflections, joint offsets, and lateral pipe intrusions.
 2. A rigid mandrel shall be pulled through the pipe by hand. Mechanical pulling device will not be allowed. The mandrel shall be rigid, nonadjustable and having an effective length of not less than its nominal interior diameter of the pipe being tested. The outside diameter of the mandrel shall be, at a minimum, 95 percent of the inside diameter of the pipe being tested after debanding.
 3. Mandrel shall be pulled through each run of installed pipe in the presence of University's Representative. If the mandrel is caught in the pipe and cannot be pulled completely through, the section of pipe where the mandrel is caught is deemed defective.
 4. All obstructions encountered by the mandrel shall be corrected by the Contractor. Obstructions due to deflection shall be corrected by replacement of the over-deflected pipe. Mechanical re-rounding is not permitted.
 5. If a section of pipe fails to meet the mandrel test and is reinstalled and fails a second time, said section(s) of pipe shall be replaced with rigid pipe material approved by the University's Representative.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to University.
- E. All tests shall be witnessed by the University's Representative. At least 48 hours notice of tests shall be given.
- F. Perform field inspection and testing in accordance with Section 01 43 00 Quality Assurance.

Note to specifier: Television inspection to be added on a project specific basis, consult University's Representative.

- G. Television Inspection shall be conducted by the Contractor for all sanitary sewer pipe 10 inches in diameter and larger.
1. The Contractor shall hire an independent television inspection service to perform a closed-circuit television inspection. A recording of the television inspection shall be produced and delivered to the University's Representative in color Digital Video Disk (DVD), together with a

typed log of the inspection. The following conditions shall exist prior to the television inspection:

- a. All sewer lines shall be installed, backfilled and compacted;
 - b. All structures shall be in place, all channeling complete and all pipelines accessible from structures;
 - c. All other underground facilities, utility piping and conduit within two feet of the sewer main, shall be installed;
 - d. All compaction required shall be completed;
 - e. Pipelines to be inspected shall be balled, flushed and mandrel tested;
 - f. The final air or water test shall have been completed.
 - g. Immediately before the television inspection, run fresh water into the sewer until it passes through the downstream manhole.
2. When the above work has been completed, the Contractor shall notify the University's Representative 48 hours in advance of the date for television inspection. During this inspection, the Contractor shall be present to observe the video pictures as provided by the television camera.
3. The following video tape observations shall be considered defects in the construction of the sewer pipelines and will require corrections prior to acceptance:
- a. Off grade - 0.08 foot, or over, deviation from grade;
 - b. Separations over 2 inches in pipe joints using couplers;
 - c. Joint separations over 3/4 inch;
 - d. Offset joints;
 - e. Chips in pipe ends - none more than 1/4 inch deep;
 - f. Cracked or damaged pipe or evidence of the presence of an external object bearing upon the pipe (rocks, roots, etc.);
 - g. Infiltration;
 - h. Debris or other foreign objects;
 - i. Other obvious deficiencies when compared to the Contract Documents.
4. The Contractor shall notify the University's Representative in writing of any deficiencies revealed by the television inspection that will require repair. The Contractor shall excavate and make the necessary repairs and conduct a television re-inspection. Television re-inspection shall be at the Contractor's expense.

3.5 COMMISSIONING

- A. Prior to putting a sewer line in service, the Contractor shall conduct an acceptance checklist as required in **Section 33 08 30 Commissioning of Sanitary Sewer Utilities**.

END OF SECTION 33 31 00