

SECTION 02533

ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acceptance testing of sanitary sewers including:
 - 1. Visual inspection of sewer pipes
 - 2. Mandrel testing for flexible sewer pipes.
 - 3. Leakage testing of sewer pipes.
 - 4. Leakage testing of manholes.
 - 5. Smoke testing of point repairs.
- B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for acceptance testing under this Section. Include payment in unit price for work requiring acceptance testing.
 - 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
- B. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- C. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity

Sewer Pipe and Fittings Based on Controlled Inside Diameter.

- D. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

1.04 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.
- B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.
- C. Perform air testing in accordance with requirements of this Section and Texas Commission on Environmental Quality requirements. Refer to Table 02533-1, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig.
- D. Televised inspection of constructed gravity sewer line.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Public Works. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.
- C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.06 GRAVITY SANITARY SEWER QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and video tape of television inspection as directed by Public Works.
- C. Upon completion of tape reviews by Public Works, Contractor will be notified regarding final acceptance of sewer segment.

1.07 SEQUENCING AND SCHEDULING

- A. Perform testing as work progresses. Schedule testing so that no more than 1000-Ft. of installed sewer remains untested at one time.
- B. Coordinate testing schedules with Public Works. Perform testing under observation of Public Works.

PART 2 PRODUCTS

2.01 DEFLECTION MANDREL

- A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, or average ID of a pipe, as specified in the appropriate standard by the ASTMs, American Water Works Association, UNI-BELL, or American National Standards Institute, or any related appendix.
- B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more odd number of "runners" or "legs". Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Adjustable or flexible mandrel is prohibited. Provide and use proving ring for modifying each size mandrel.
- C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-In. thick, 3-In. wide bar steel to diameter 0.02-In. larger than approved mandrel diameter.
- D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 02533-3, Pipe vs. Mandrel Diameter, at end of this Section and as shown on the City of Schertz Standard Detail. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Public Works.

2.02 LOW PRESSURE AIR TEST

- A. Minimum Requirement for Equipment:
 - 1. Control panel
 - 2. Low-pressure air supply connected to control panel.
 - 3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested;

capable of withstanding internal test pressure without leaking or requiring external bracing.

4. Air hoses from control panel to:
 - a. Air supply.
 - b. Pneumatic plugs.
 - c. Sealed line for pressuring.
 - d. Sealed line for monitoring internal pressure.

- B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.03 SMOKE TESTING

- A. Equipment:
 1. Pneumatic plugs.
 2. Smoke generator as supplied by Superior Signal Company, or approved equal.
 3. Blowers producing 2500 scfm minimum.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01578 - Control of Ground Water and Surface Water.

3.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

- A. Check pipe alignment visually by flashing light between structures. Verify if

alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

- B After testing and prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection per Section 02531.

3.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- C. Re-test repaired or replaced sewer sections.

3.04 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

- A. Test gravity sanitary sewer pipes for leakage by Low Pressure air testing. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
- B. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in [Table 02533-1](#).
 - 1. Air testing for sections of pipe shall be limited to lines less than 36-In. average inside diameter.
 - 2. Lines 33-In. average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
 - 3. For pipe sections less than 33-In. average inside diameter:
 - a. Determine ground water level.
 - b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.

- c. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
 - d. Pressurize pipe to 4.0 psi or 3.5 psi greater than the pressure exerted by ground water above the pipe. Bleed back pressure to start at 3.5 psig (plus adjustment for ground water table). See [Table 02533-1](#) at end of this Section.
 - e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in [Table 02533-1](#) at end of this Section for pipe diameter and length. For slip-lining, use diameter of carrier pipe. A minimum of five (5) readings will be required for each test.
- F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.05 LEAKAGE TESTING FOR MANHOLES

- A. After completion of manhole construction and backfilling, test manholes for water tightness using vacuum testing procedures.
- B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6-In. outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.
- C. Vacuum testing:
 - 1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
 - 2. Evacuate manhole with vacuum pump to 10-In. mercury (Hg), disconnect pump, and monitor vacuum for 2 minutes, per 30 TAC Chapter 217 Rule 217.58.
 - 3. If drop in vacuum exceeds 1-In. Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are

obtained.

3.06 SMOKE TEST PROCEDURE FOR POINT REPAIRS

- A. Application: Perform smoke test to:
 - 1. Locate points of line failure for point repair.
 - 2. Determine when point repairs are properly made.
 - 3. Determine when service connections have been reconnected to rehabilitated sewer.
 - 4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.
- B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.
- C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to City of Schertz Police and Fire Departments 24 hours prior to actual smoke testing.
- D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for slip-lined sections.
- E. Smoke Introduction:
 - 1. Operate equipment according to manufacturer's recommendation and as approved by Public Works.
 - 2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
 - 3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.
- F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work

day, properly barricade and cover each excavation as approved by Public Works.

- G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

Table 02533-1. ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG			
Pipe Dia. (in)	Min. Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec/ft)
6	5:40	398	0.8548
8	7:33	298	1.5196
10	9:27	239	2.3743
12	11:20	199	3.4190
15	14:10	159	5.3423
18	17:00	133	7.6928
21	19:50	114	10.4708
24	22:40	99	13.6762
27	25:30	88	17.3089
30	28:20	80	21.3690
33	31:10	72	25.8565

Table 02533-2. Pipe vs. Mandrel Diameter

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches)	Minimum Diameter (Inches)
PVC-Solid (SDR 26)6	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)12	12	11.737	11.15
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.12
	27	26.351	25.033
PVC-Truss	8	7.75	7.363
	10	9.75	9.263
	12	11.79	11.201
	15	14.77	14.032
PVC-Profile (ASTM F 794)	12	11.74	11.153
	15	14.37	13.652
	18	17.65	16.768
	21	20.75	19.713
	24	23.5	22.325
	27	26.5	25.175
	30	29.5	28.025
	36	35.5	33.725
	42	41.5	39.425
	48	47.5	45.125
HDPE-Profile	18	18	17.1
	21	21	19.95
	24	24	22.8
	27	27	25.65
	30	30	28.5
	36	36	34.2
	42	42	39.9
	48	48	45.6
	54	54	51.3
	60	60	57

END OF SECTION