SAN ANTONIO RIVER AUTHORITY
UTILITIES DEPARTMENT

SECTION 33-05-06
SANITARY SEWER TESTING

PART 1 GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

Section 01-33-00 - Submittals
Section 33-05-05 - Sewer Excavation, Trenching and Backfilling
Section 33-01-31 - Sewer Main TV Inspection

B. SCOPE:

All sanitary sewer lines shall be tested by the CONTRACTOR on completed sections. The air and mandrel tests results will be used to evaluate materials and construction methods on the pipeline sections, and successful tests shall be mandatory for the acceptance of the lines.

Testing shall not be conducted until all other utilities within the vicinity to the sanitary sewer lines have been fully installed. All testing shall be conducted in accordance with TAC 217.57 and TAC 217.58 and these specifications.

C. SUBMITTALS:

Prior to the start of testing, CONTRACTOR shall submit, for OWNER'S approval, the following:

1. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval. Include testing procedures, dates, inspector, project name, methods, equipment, and tentative schedule.

2. Deviations from Drawings and Specifications shall not be accepted unless written approval is provided by OWNER.

3. Submit all preliminary and final testing reports to OWNER for each test conducted. The final testing report shall include as-built drawings, CCTV flash drives, compaction/density reports for all sewer main and laterals, and all applicable warranty letters.

4. CONTRACTOR shall provide written notice to OWNER's inspector 48 hours prior to testing.

PART 2 PRODUCTS

2.1 MATERIALS:

A. A compressor capable of providing at least three-hundred (300) cubic feet per minute (cfm) at one-hundred (100) pounds per square inch (psi) shall be furnished by the CONTRACTOR.

B. Plugs, valves, pressure gauges, air hose, connections, control panel and other equipment necessary to conduct the air test shall be furnished by the CONTRACTOR.

C. Mandrel equipment shall be submitted for approval prior to testing.

PART 3 EXECUTION

3.1 GENERAL:

A. Testing can be performed by a professional engineer licensed in the State of Texas with prior approval by the OWNER. If the OWNER is not witnessing the testing, documentation of passing tests must be signed and sealed by an engineer and submitted to the OWNER.

B. If a gravity collection main is composed of flexible pipe, a deflection test will also be required.

C. If installing a lateral to connect to an existing sanitary sewer main that has five (5) or more laterals connected, additional testing will be required.

3.2 AIR TEST PROCEDURES:

A. The procedures for the low-pressure air test shall conform to the procedures described in *ASTM C-828, ASTM C-924, ASTM F-1417, TCEQ Chapter 217,* or other appropriate procedures, except for testing times. The test time shall be as outlined in this section.

B. Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. Backfilling to grade shall be completed and all laterals, stubs, and openings shall be capped or plugged by the CONTRACTOR before the test. Manholes are to be plugged so they are isolated from the pipe and cannot be included in the test. Under no circumstances is one section of pipe or material (i.e. ductile iron pipe) to be tested with another pipe section or material (i.e. PVC pipe) at the same time. Different sections of pipe are to be tested separately.

C. For sections of pipe less than 36-inch average diameter, the maximum time allowable for the pressure to drop from 3.5 pounds per square inch gauge (psig) to 2.5 psig shall be computed by the following equation:

$$T = \frac{0.085(D)(K)}{Q}$$

T = Time for the pressure to drop 1.0 psig in seconds
K = 0.000419 (D)(L), but not less than 1.0
D = Average inside pipe diameter in inches
L = Length of line of same pipe size being test, in feet
Q = Rate of loss, assume 0.0015 cubic feet per minute per square foot internal surface shall be used since a K value of less than 1.0 shall not be used.

D. Allowable test times for selected type pipe less than 36 inches average inside diameter shall be as follows:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds/foot)
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1,020	133	7.693
21	1,190	114	10.471
24	1,360	100	13.676
27	1,530	88	17.309
30	1,700	80	21.369
33	1,870	72	25.856

*Note: Test time starts after the required 60 seconds of stabilization time has transpired.

E. The OWNER may stop a test if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of a testing period, then the test must continue for the entire test duration as outlined above or until failure.

F. When a main line with connected laterals is to be tested as a unit or when the line tested includes more than one pipe size, calculate the test times for each size and add the test times to arrive at the total minimum test time for the section. Any drop in pressure, from 3.5 psig to 2.5 psig greater than average back pressure of any ground water as required by the above table or formulas shall be cause for rejection. The CONTRACTOR must determine the cause of test failure and repair as may be required to accomplish a successful air test.

G. Test over individual joints or "joint tests" shall be performed in the same manner as stated herein with the minimum allowable test time determined from the above table or formulas for a minimum of ten (10) feet of length. Pipes sizes 36 inches inside diameter and larger shall be "joint tested", and each joint shall be visually inspected immediately after testing. Pipes under 36 inches inside diameter may be "joint tested" with the approval of the OWNER. Maximum time allowable for the pressure to drop shall be 20 seconds regardless of pipe size.

3.3 DEFLECTION TESTING

A. For a collection system pipe with an inside diameter less than 27 inches, deflection measurement requires a rigid mandrel.

B. The rigid mandrel shall have an outside diameter (O.D.) not less than 95% of the inside diameter (I.D.) of the pipe.

C. Mandrel Design:

1. The rigid mandrel shall be constructed of a metal that can withstand 200 psi without being deformed.

2. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number.

3. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe.

4. A proving ring shall be provided and used for each size mandrel in use.

D. Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test.

E. A deflection test method must be accurate to within plus or minus 0.2% deflection.

F. The test shall be conducted 30 days after backfill has been placed and trench has been fully compacted. A wiper shall be pulled to adequately clean the line prior to testing.

G. Other underground utilities, such as, but not limited to water, gas, electric, and telecom, that are within the vicinity of the sanitary sewer line must be installed prior to testing.

H. No pipe shall exceed a deflection of 5%.

I. If a pipe should fail to pass the deflection test, the problem shall be corrected, and a second test shall be conducted after the failed area's final backfill has been in place an additional 30 days.

J. The tests shall be performed without mechanical pulling devices.

K. Upon completion of construction, the OWNER or other Texas Registered Professional Engineer appointed by the OWNER shall certify that the entire installation has passed the deflection test.

L. This certification may be made in conjunction with the notice of completion required in *TCEQ Chapter 217.14*.

M. This certification shall be provided for the OWNER to consider the requirements of the approval have been met.

3.4 VACUUM TESTING FOR SANITARY SEWER MANHOLES

A. Successful passage of a vacuum test shall be required for acceptance of all sanitary sewer manholes and sanitary sewer structures. Vacuum testing shall be conducted using an OWNER approved vacuum tester.

B. CONTRACTOR shall notify the OWNER 48-hours prior to testing and only after a successful pre-test has been performed. Pre-testing after connections is made but before backfilling is recommended to facilitate better and easier repair if required.

C. The following procedures shall be followed:

SECTION 33-05-06
SANITARY SEWER TESTING

1. Plug all manhole inverts and lift holes. Inverts shall be plugged using suitably-sized pneumatic or mechanical pipeline plugs. The plugs shall be placed a minimum of six inches (6") beyond the manhole wall to prevent temporary sealing of the inverts. Follow all manufacturer's recommendations and warnings for proper and safe installation of such plugs. Make sure such plugs are properly rated for the pressure required for the test. The standard test of ten inches of mercury(inHg) is equivalent to approximately 5 PSIG (0.3 bar) back pressure. Unless such plugs are mechanically restrained, it is recommended that the plugs used have a two-times (2X) safety factor or a minimum 10 PSIG (0.7 bar) back pressure using rating. Caution: Brace inverts if lines entering the manhole have not been backfilled to prevent pipe from being dislodged and pulled into the manhole.

2. Install the vacuum tester head assembly at the top access point of the manhole, preferably the ring area. Adjust the cross brace to ensure that the inflatable sealing element inflates and seals against the straight top section of the manhole structure. Do not pressurize the manhole – this may result in manhole damage and/or result in manhole test plug dislodging from manhole inlet.

3. Attach the vacuum pump assembly to the proper connection on the test head assembly. Make sure the vacuum inlet/outlet valve is in the closed position.

4. Following all safety precautions and manufacturer's instructions, inflate sealing element to the recommended maximum inflation pressure. Do not over-inflate

5. Start the vacuum pump assembly engine and allow preset RPM to stabilize.

6. Open the inlet/out ball valve and evacuate the manhole to ten-inch (10") Hg (0.3 bar).

7. Close vacuum inlet/out ball valve, disconnect vacuum pump, and monitor vacuum for the specified time period. If the vacuum does not drop more than 1-inHg over the specified time period, the manhole is considered acceptable and passes the test.

VACUUM TEST TIMETABLE			
	DIAMETER (INCHES)		
Depth (feet)	48"	60"	72"
4	10 sec.	13 sec.	16 sec.
8	20 sec.	26 sec.	32 sec.
12	30 sec.	39 sec.	48 sec.
16	40 sec.	52 sec.	64 sec.
20	50 sec.	65 sec.	80 sec.
24	60 sec.	78 sec.	96 sec.
*	05 sec.	6.5 sec.	8.0 sec.
* Add indicated times for each additional 2' depth. (The values listed above have been extrapolated from ASTM designation C924-85)			

8. If the manhole fails the test, identify the leaking areas by removing the head assembly, coating the interior surfaces of the manhole with a soap and water solution, and repeating the vacuum

test for approximately thirty seconds. Leaking areas will have soapy bubbles. Once the leaks have been identified, complete all necessary repairs and repeat test procedures until satisfactory results are obtained. Repeat the above test procedure after backfilling for final acceptance test.

D. Alternate manhole testing

1. Manholes may be hydrostatic tested as an alternate to vacuum testing if approved by the OWNER.

2. Hydrostatic testing shall be conducted using OWNER approved plugs for all influent and effluent pipes in the manhole and filling the manhole with water to the top of the manhole cone. Additional water may be added over a twenty-four (24) hour period to compensate for absorption and evaporative losses.

3. At the conclusion of the twenty-four (24) hour saturation period, the manhole shall be filled to the top of the manhole cone and observed. Any loss within a thirty (30) minute period shall be considered an unsuccessful test.

E. CONTRACTOR to ensure all plugs used to plug sewer lines, while testing the project labeled, marked or tagged. OWNER will record how many plugs are being used, location and I.D., within the collection system. CONTRACTOR will report to OWNER of any lost or unrestrained plugs into the sewer collection system. Only screw type plugs will be accepted by OWNER.

F. CONTRACTOR will be held liable for any damages to sewer collection system stoppages, over-flows, backup into homes caused by lost, run-away sewer plugs that were used on that project or outfall line wastewater treatment plants.

G. CONTRACTOR will also be responsible for any damage to wastewater treatment apparatus, such as screw pumps, etc. caused by lost or run-away sewer plugs. CONTRACTOR will be held liable for damages as well as cost of repairs.

PART 4 MEASUREMENT AND PAYMENT

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this contract and shall not be paid for separately.

END OF SECTION