



TECHNICAL NOTE

Post Installation Testing of SaniTite® HP

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Introduction

Sanitary sewer is often tested after or during installation to ensure a sound installation was accomplished. Types of post installation field testing include deflection testing and joint testing. Specific testing required for the project will be found in the project specifications. This technical note is not meant to supersede any project specification, but should be used in conjunction with the project specification and national testing standards as it relates specifically to SaniTite HP pipe.

Deflection Testing

An important feature of any flexible pipe is its ability to deflect, or oval, under load without structural distress. Deflection allows the load to be transferred from the pipe to the surrounding backfill. The result is flexible pipe can withstand very high loads as a relatively light structure. Flexible pipe – including SaniTite HP – *must* deflect in order to mobilize the strength of the surrounding backfill.

According to current thermoplastic design procedures, deflection is defined as a service limit. The designer, considering all site conditions, will set this service limit in order to perform a proper design evaluation. Deflection in excess of this service limit does not necessarily result in strength limits being exceeded, i.e. system failure. For more information on service and strength limit states, see the *Structures* section of the Drainage Handbook. SaniTite HP can be expected to perform satisfactorily in most applications with 5% or 7.5% deflection and so it is typical of designers to choose a service limit in this range.

When testing for allowable deflection limits, the minimum inside diameter should be used when establishing mandrel sizing. The minimum inside diameter accounts for the allowable manufacturing tolerances. Table 1 lists the inside diameters that result from 5% and 7.5% deflection from the minimum inside diameter. Values listed in Table 1 should be used for sizing mandrels for deflection testing. Mandrels may be obtained from a variety of commercial suppliers.

Table 1
SaniTite HP Recommended Mandrel Settings

Pipe Type	Pipe Diameter	Minimum Inside Diameter	Inside Diameter with 5% Deflection	Inside Diameter with 7.5% Deflection
Dual Wall	12	11.90	11.31	11.01
	15	14.85	14.11	13.74
	18	17.93	17.03	16.59
	24	23.90	22.71	22.11
	30	29.79	28.30	27.56
Triple Wall	30	29.62	28.14	27.40
	36	35.40	33.63	32.75
	42	41.31	39.24	38.21
	48	47.31	44.94	43.76
	60	59.30	56.34	54.85

It is important to understand that mandrel testing is a go/no-go test. If any line were to not pass a mandrel, it is important to ascertain the cause. Obstructions in the line, not associated with deflection, may influence the test. Visual inspection is recommended in the event of a no-go result.



Joint Testing

Joint testing is an important part of any sanitary sewer system, both in testing for infiltration and exfiltration. Infiltration aids to estimate the amount of sewer water that will be conveyed to, and ultimately treated by, the waste water treatment plant. Exfiltration aids to estimate the loss of sewage water into the surrounding soil. The two primary ways of testing sewer pipe joints for infiltration and/or exfiltration is using air or water to create a constant pressure within the system.

Exfiltration Testing with Air

Air is a compressible gas and so it is extremely important one adheres to the appropriate safety regulations outlined in OSHA and project specifications. There are two primary national testing standards that may be applied to joint testing SaniTite HP: ASTM F1417 *Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air*, and ASTM C1103 *Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines*. When either standard is specified by the project plans, one should review the standards carefully and follow the testing procedure and safety precautions outlined. The below commentary on the ASTM testing procedures should be considered a summary and does not replace the testing procedures outlined in their respective specifications.

ASTM F1417 entails testing a run of pipe from one manhole to the next adjacent manhole. Inflatable plugs are positioned into the manholes and secured. Air is introduced into the pipe line and gradually builds pressure. Once the line has been pressurized and is stable at 4.0-psi, the pressure is decreased to 3.5-psi at which time the line must not lose more than 0.5- or 1.0-psi (whichever is specified by the design engineer) in the specified amount of time. Table 2 below summarizes the minimum time that must be reached for less than 0.5- or 1.0-psi of pressure drop, depending on the diameter and length of pipe being tested.

**Table 2
Time to Pressure Drop for SaniTite HP (per ASTM F1417)**

Pipe Diameter	Pressure Drop (psi)	Minimum Test Time (min:sec)	Length for Minimum Time, (ft)	Time for Longer Lengths, (sec)	Time for Length Shown, (min:sec)							
					100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
12	0.5	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
	1.0	11:20		3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	0.5	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
	1.0	14:10		5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	0.5	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
	1.0	17:00		7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
24	0.5	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
	1.0	22:40		13.764 L	22:47	34:11	43:34	56:58	68:22	79:46	91:10	102:33
30	0.5	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
	1.0	28:20		21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
36	0.5	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
	1.0	34:00		30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42 ³	0.5	19:54	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
	1.0	39:48		41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48 ³	0.5	22:47	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	208:09
	1.0	45:34		54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
60 ³	0.5	28:20	40	42.738 L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32
	1.0	56:40		85.476 L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

Data taken from ASTM F 1417¹ and Uni-Bell, Uni-B-6-98³.

It may not be necessary to hold the test for the entire time period listed above when it is evident that the rate of air loss is zero or less than the allowable pressure drop and authorized by the approving authority¹.



When the pipe is large enough to be physically accessed, it may be desirable to test individual joints for safety reasons. In these cases, one may consider joint testing in accordance with ASTM C1103, also known as a joint isolation test. This test is typically done with air, though water may also be used, and involves the use of special testing equipment. The equipment consists of two inflatable bladders, placed on each side of the joint, creating an open center cavity between them. The bladders are inflated and then the center cavity is pressurized to 3.5 psi. The joint passes the test if the pressure is held for 5 seconds without dropping more than 1.0-psi. For all practical purposes, this is a go/no-go test. One advantage of this type of test is the ability for the installer to quickly test the joint immediately after installation, allowing for any corrective measures to be taken early on in the project.

Infiltration/Exfiltration with Water

Testing sanitary sewer joints via water infiltration or exfiltration is a common practice. For SaniTite HP, this testing should be conducted in accordance with ASTM F2487 *Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines*, or ASTM C969, *Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines*. These standards entail first observing the ground water conditions and, if applicable, measuring the infiltration rate of the ground water through the joints. If ground water is not applicable, then the line is filled with water and the leakage is observed through exfiltration.

For the infiltration test the ground water must be at least 2 feet above the crown of the pipe for the entire test section. If this groundwater condition is not present, exfiltration testing should be used. Measure the groundwater elevation and determine the average head, relative to the pipe invert, over the test section. All outlets discharging into the upstream manhole shall be plugged. Measure the infiltration leakage at the outlet of the test section. The leakage may be small and is best measured by timing the filling of a container of known volume or by directing the flow into a container for a specified time and measuring the volume. Weirs may also be used to measure the flow.

Exfiltration testing is appropriate when the groundwater condition is less than 2 feet above the crown of the pipe measured at the upstream end. All outlets discharging into the upstream end of the test section as well as the downstream end shall be plug. At the upstream manhole the test head shall be established at a minimum of 2 feet above the crown of the pipe or 2 feet above the existing ground water condition, which ever is higher. The leakage shall be measured over a timed test period of not less than 15 minutes and no more than 24 hours. Leakage may be measured through observation in a water column or by adding water at a known rate to satisfy a constant water elevation.

Manholes shall be tested separately and independently of the pipe line to the requirements established in the project specifications. When water level is measured in the manhole for the exfiltration test, the leakage associated with the manhole shall be subtracted from the overall leakage of the test section to establish a pass or fail grade for the pipe.

Allowable Leakage

The allowable leakage rate for SaniTite HP is 50 gallons/in-dia/mi-pipe/day for both infiltration and exfiltration when done in accordance with ASTM F2487, C969 and this technical note. In the event the average groundwater head exceeds 6 feet in the infiltration test, the allowable leakage shall be increased by the ratio of the square root of the average groundwater head to the square root of the 6 feet head. In the event the average head exceeds 3 feet in the exfiltration test, the allowable leakage shall be increased by the ratio of the square root of the average test head to the square root of the 3 feet head. Table 3 below summarizes the equations needed to calculate the adjusted leakage allowance with increase head pressures.

**Table 3
Adjusted Leakage Allowance for Increased Head Pressures⁵**

Infiltration	Exfiltration
$\text{Allowable Leakage} = 50 \times \frac{\sqrt{\text{Average Groundwater Head}}}{\sqrt{6}}$	$\text{Allowable Leakage} = 50 \times \frac{\sqrt{\text{Test Head}}}{\sqrt{3}}$



Conclusion

ADS SaniTite HP is intended for gravity flow sanitary sewer applications and may be tested for deflection and joint tightness as discussed in this technical document. It is important to note that the testing procedures are no different than for other sanitary sewer products currently being used in the market. This document does not purport to address the safety concerns associated with testing SaniTite HP. Any questions associated with testing SaniTite HP can be directed to your local representative.

References

1. ASTM F1417, *Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air*, ASTM, 2005
2. C1103, *Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines*, ASTM, 2003
3. Uni-B-6-98, *Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe*, Uni-Bell PVC Pipe Association, 1998
4. ASTM F2487, *Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines*, ASTM, 2006
5. ASTM C969, *Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines*, ASTM, 2002