Designation: ~~F1417 – 11a~~ F1417 – 11a (Reapproved 2015)

Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air[1]

This standard is issued under the fixed designation F1417; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice provides procedures for testing non-pressure plastic pipe sewer lines, using low-pressure air to prove the integrity of the installed material and the construction procedures. Two procedures are included to find the rate of air leakage—the constant-pressure method and the time-pressure drop method.

1.2 This practice is performed on lines after all connections and service laterals have been plugged and braced adequately to withstand the test pressure. The time between completion of the backfill operation and low-pressure air testing may be specified by the approving authority.

1.3 This practice is used as a preliminary test, which enables the installer to show the condition of a buried line prior to final backfill, paving, and other construction activities.

1.4 This practice is applicable to all non-pressure sewer lines made of thermoplastic pipe, reinforced thermosetting resin (RTRP) pipe, and reinforced plastic mortar (RPM) pipe, defined in Terminology D883, D1600, and F412.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see Section 5.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C828 Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines

C924 Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Withdrawn 2013)[3]

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

2.2 *Uni-Bell PVC Pipe Association Standard:*[4]

UNI-B-6 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

3. Summary of Practice

3.1 The section of the line to be tested is plugged. Air, at low pressure, is introduced into the plugged line. The line passes the test if the rate of air leakage, as measured by a constant-pressure method or a time-pressure drop method. The rate of air leakage may be determined by using Table 1 or Table 2, or calculated by use of the equations in Section 9.

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[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer.

Current edition approved ~~Aug. 1, 2011~~Aug. 1, 2015. Published ~~August 2011~~November 2015. Originally approved in 1992. Last previous edition approved in 2011 as F1417~~F1417–11.~~–11a. DOI: ~~10.1520/F1417-11A.~~10.1520/F1417-11AR15.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from Uni-Bell PVC Pipe Association, ~~Suite 155, 2655 Villa Creek Drive, Dallas, TX 75234.~~2711 Lyndon B. Johnson Freeway, Suite 1000, Dallas, TX 75234, http://www.uni-bell.org.

***A Summary of Changes section appears at the end of this standard**

TABLE 1 Minimum Time for a ~~1.0 psig~~ 1.0-psig Pressure Drop for Size and Length of Pipe for *Q* = 0.0015

NOTE 1—See Practice UNI-B-6.

NOTE 2—Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 in. in diameter.

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85.476 L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

TABLE 2 Minimum Time for a ~~0.5 psig~~ 0.5-psig Pressure Drop for Size and Length of Pipe for *Q* = 0.0015

NOTE 1—Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 in. in diameter.

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618 L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:20	40	42.738 L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

4. Significance and Use

4.1 This low-pressure air testing practice detects damaged piping or improper jointing by measuring the rate at which air under pressure escapes from an isolated section of sewer.

4.2 The rate of air loss indicates the presence or absence of damaged piping or leaking joints. This practice is not intended to show total system water leakage limits and shall not be used as a quantitative measure of leakage under service conditions for infiltration or exfiltration.

NOTE 1—A finding of acceptable air loss specified in this practice can be interpreted as an installation acceptance test in lieu of infiltration or exfiltration testing.

4.3 This practice provides assurance of initial condition and quality of workmanship of properly-installed sewer pipe.

5. Apparatus

5.1 *Plugs*—Mechanical or pneumatic type.

5.2 *Air Compressor*—A properly calibrated portable, oil-free air source with a singular control panel containing a main shut-off valve, pressure-regulating valve, ~~9 psig~~ 9-psig pressure-relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from 0 psi to at least 10 psi with minimum divisions of 0.10 psi and an accuracy of ~~± 0.04~~ ±0.04 psi.

5.3 *Rotameter,* standard CFM reading with an accuracy of ~~± 2 %.~~ ±2 %.

5.4 *Time ~~measuring equipment—~~Measuring Equipment—*A stopwatch or watch with a second hand or digital readout in minutes and seconds with an accuracy of 0.1.s.

6. Safety Precautions

6.1 This low-pressure air testing practice may be dangerous to personnel if, through lack of understanding or carelessness, a line is over-pressurized or plugs/caps are installed or restrained improperly. It is extremely important that the various plugs be properly installed, restrained and braced to prevent the sudden expulsion of a poorly installed or partially inflated plug. Observe the following minimum safety precautions:

6.1.1 During testing, no one shall be allowed in manholes or in the possible path of a suddenly expelled cap or plug.

6.1.2 Install and restrain all caps and plugs securely.

6.1.3 When lines are tested, it is mandatory that all the caps and plugs shall be braced as an added safety factor.

6.1.4 Do not over-pressurize the lines. Do not exceed 9.0 psig.

NOTE 2—The axial force on a plug at 9 psig internal pressure is $F = P \pi D^2/4$ lb, where D is the inside diameter in inches. For example, the axial force on an 30-in. plug at 9.0 psig maximum allowable pressure is over ~~6 300~~ 6 300 lb. Restraint systems must be designed to handle these forces with adequate safety factors. Every effort should be made to maintain backfill over the pipe during air testing.

6.1.5 A regulator or relief valve set no higher than 9 psi shall be included on all pressurizing equipment.

7. Preparation of the Line

7.1 Clean the section of sewer line to be tested by flushing or other means prior to conducting the low-pressure air test. This cleaning serves to eliminate debris and produce consistent results.

8. Procedures

8.1 Isolate the section of sewer line to be tested by inflatable stoppers or other suitable test plugs or caps.

8.1.1 The ends of all branches, laterals, tees, wyes, and stubs included in the test section shall be plugged or capped to prevent air leakage. All plugs and caps shall be securely braced to prevent blow-out. One of the plugs or caps shall have an inlet tap, or other provision for connecting an air hose to a portable air control source.

8.1.2 Connect the air hose to the inlet tap and to the portable air source and control equipment. The air equipment shall consist of necessary valves and pressure gages to control an oil-free air source, to control the rate at which air flows into the test section, and to enable monitoring of the air pressure within the test section.

8.1.3 Add air slowly to the test section until the pressure inside the test section reaches 4.0 psig.

8.1.4 After the pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 to 4.0 psig for at least 2 min. Depending on air/ground temperature conditions, the internal air temperature will stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until equilibrium is obtained; however, a minimum of 3.5 psig is required.

8.2 After equilibrium is obtained, determine the rate of air loss by either the constant pressure method or the time-pressure drop method.

NOTE 3—All test pressures are measured as gauge pressure, which is any pressure greater than atmospheric pressure. Since water produces a pressure of 0.43 psi for every foot of depth, air test pressures must be increased to offset the depth of ground water over the sewer line. If the ground water level is 2 ft or more above the top of the pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gauge, this air testing practice should not be used. Before this air testing practice is used, the ground water level should be lowered by pumping or dewatering.

8.2.1 *Constant Pressure Method*—Add air until the internal air pressure of the test section is raised to 4.0 psig and the test section is stabilized as in 8.1. Reduce pressure to 3.5 psig to run the constant pressure test. The air-flow rate in standard cubic feet per minute is read directly by a rotameter. Convert this air-flow rate to actual cubic feet per minute of air leaking from the test section by using the absolute pressure and temperature in the test section. The requirements for air loss under the constant pressure method shall be considered satisfied if the air loss does not exceed the specified leakage rate in cubic feet per minute per square foot of internal pipe surface area.

8.2.2 *Time-Pressure Drop Method*—Air is slowly introduced into the test section, until the air pressure is raised to approximately 4.0 psi and the test section is stabilized as in 8.1. Disconnect the air supply and decrease the pressure to 3.5 psi before starting the test. Determine pressure drap time per 8.2.2.1 and 8.2.2.2.

8.2.2.1 *1.0 psig pressure drop*—Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi, and compare this interval to the minimum time for the pipe diameter and the length per Table 1. If the rate of air loss is greater than or equal to the minimum time for the pipe diameter and length per Table 1, the installation is acceptable.

8.2.2.2 *0.5 psig pressure drop*—Determine the time required for the pressure to drop from 3.5 psi to 3.0 psi, and compare this interval to the minimum time for the pipe diameter and length per Table 2. If the rate of air loss is greater than or equal to the minimum time for the pipe diameter and length per Table 2, the installation is acceptable.

NOTE 4—The time-pressure drop method assumes an atmospheric pressure of 14.7 psia. Locations of high altitude need compensation for variation