



Designation: C 1091 – 03

Standard Test Method for Hydrostatic Infiltration and Exfiltration Testing of Vitrified Clay Pipe Lines¹

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1. Scope

1.1 This test method defines procedures for hydrostatically testing vitrified clay pipe lines, to demonstrate the structural integrity of the installed line. Refer to Practice C 12.

1.2 This test method is suitable for testing gravity-flow pipe lines constructed of vitrified clay pipe or combinations of clay pipe and other pipe materials.

1.3 This test method is applicable to the testing of the pipe lines only. Manholes or other structures should be tested separately.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 12 Practice for Installing Vitrified Clay Pipe Lines²

C 828 Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines²

C 896 Terminology Relating to Clay Products²

3. Terminology

3.1 Terminology C 896 can be used for clarifications of terminology in this test method.

4. Summary of Test Method

4.1 This test method shall be performed on lines after connection laterals, if any, have been plugged and adequately braced to withstand the test pressure, and after the trenches have been backfilled for a sufficient time to generate a

significant portion of the ultimate trench load on the pipe line. The time between completion of the backfill operation and hydrostatic testing shall be established by the approving authority.

5. Significance and Use

5.1 The tests called for herein, for their results, indicate the acceptability of installed vitrified clay pipelines.

6. Preparation of the Line

6.1 To ensure the proper seating of the test plugs and the accuracy of the test, the lines should be cleaned prior to testing.

6.2 Examples of methods for cleaning the lines are the sewer cleaning ball and high pressure flushing equipment.

7. Procedure

7.1 *Infiltration Testing:*

7.1.1 This test procedure is applicable where the measured water table is 2 ft (610 mm) or greater above the pipe barrel at the midpoint of the test section (see Note 1). Where the ground water elevation is indeterminate, less than 2 ft (610 mm) above the top of the pipe barrel, or the line is partially below the water table, use a combination of both the air test and infiltration procedure.

NOTE 1—What can be called false infiltration represents condensate on the pipe walls. This may amount to as much as 50 gal/in. diameter-mile-day (4.6 L/mm diameter-kilometre-day). Thus, evaluate flow in the pipeline for this condition.

7.1.2 Determine the allowable infiltration rate for the test section using Table 1.

7.1.3 Discontinue all pumping of ground water for a period of 24 h prior to testing.

7.1.4 Plug the inlet to the test section to be tested. It is usually necessary to also plug the inlet of the upper manhole to prevent the manhole from filling with water or provide a method of de-watering the manhole or remotely removing the plug at the inlet to the test section. Securely plug all lateral inlets to the line.

7.1.5 To determine the infiltration rate, measure the flow at the outlet of the test section.

¹ This test method is under the jurisdiction of ASTM Committee C04 on Vitrified Clay Pipe and is the direct responsibility of Subcommittee C04.20 on Methods of Test and Specifications.

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² *Annual Book of ASTM Standards*, Vol 04.05.

**TABLE 1 Allowable Infiltration/Exfiltration Test Rate in Gallons/
100 ft of Line/Hour (Litres/Metre/Hour)**

nominal pipe size, in. (mm)	gal/100 ft/h (L/m/h)	nominal pipe size, in. (mm)	gal/100 ft/h (L/m/h)
48 (1220)	7.58 (0.941)		
4 (100)	0.63 (0.78)	21 (535)	3.31 (0.410)
6 (150)	0.95 (0.118)	24 (610)	3.79 (0.471)
8 (205)	1.26 (0.156)	27 (685)	4.26 (0.529)
10 (255)	1.58 (0.196)	30 (760)	4.73 (0.587)
12 (305)	1.89 (0.234)	33 (840)	5.21 (0.646)
15 (380)	2.37 (0.294)	36 (915)	5.68 (0.704)
18 (455)	2.84 (0.352)	39 (990)	6.16 (0.764)
...	...	42 (1065)	6.63 (0.822)

7.1.5.1 At the outlet of the test section, collect the water and measure the quantity collected within a specific time. Achieve collection and measurement with the use of a plug having a pipe outlet and a calibrated container after constant flow is generated at the pipe outlet.

7.1.5.2 An alternate method of measurement is to use a calibrated weir (see Note 2) installed at the outlet of the test section and directly read the rate of flow.

NOTE 2—The apex of weir should be as near to the pipe invert as practical.

7.1.6 If the allowable infiltration rate (see Table 1) is exceeded, the line is presumed to have failed the test.

NOTE 3—The most practical method for testing is Test Method C 828, and is recommended. However, where ground water is present and meets the criteria established in 7.1.1, the infiltration test procedure outlined in this practice is recommended.

7.2 *Exfiltration Testing*—Although hydrostatic exfiltration testing is covered in this test method, it is suggested that the preferable test used in most cases is Test Method C 828. Coordinate Test Method C 828 with the infiltration test, outlined in this test method, where ground water is present, as described in 7.1.1.

7.2.1 Determine the allowable exfiltration rate for the test section using Table 1.

7.2.2 Plug the outlet of the test section being tested and brace securely. All lateral inlets shall be securely plugged.

7.2.3 Plug the inlet to the test section being tested and brace securely. This plug shall contain a fitting which will allow a standpipe to be attached.

7.2.4 Affix a standpipe with a minimum of 2-in. (50-mm) diameter to the plug and adequately support. The standpipe will be of sufficient length to provide a minimum 2-ft (610-mm) head over the pipe barrel at the upper end of the test section. The maximum head at any location in the test section shall not exceed 10-ft (3.05 m). If this is exceeded, it is necessary to either segmentally test the test section or conduct the air test (see Test Method C 828).

7.2.5 Add water to the test section and maintain the head for a minimum period of 4 h to allow for water absorption in the pipe or release of trapped air, or both.

7.2.6 Perform the test by maintaining the head in the standpipe by the addition of water and recording the volume of water added and the time elapsed.

7.2.7 If the water loss exceeds the allowable rate, the test section is presumed to have failed the test.

7.3 Test Rate:

7.3.1 The test rate table is based on the standard of 200 gal/in. diameter-mile-day (18.5 L/mm diameter-kilometre-day).

7.3.1.1 Table 1 shows the allowable infiltration/exfiltration rate in gallons per 100 ft (30.5 m) of pipe per hour (litres/metre-hour) for each nominal pipe size.

7.3.2 If the test section includes more than one pipe size, calculate the allowable test rate for each size and add to arrive at the total allowable test rate for the test section.

8. Testing Time

8.1 Terminate the infiltration test when sufficient water is collected or measured, or both, to establish the test rate.

8.2 Terminate the exfiltration test when sufficient water has been added to the standpipe to establish the test rate, but not less than 30 min.

9. Precision and Bias

9.1 No statement is made about either the precision or bias of this test method for measuring gallons (litres) and time, since the results merely state whether there is conformance to the criteria for success specified in the procedure.

10. Keywords

10.1 clay pipe; exfiltration; hydrostatic test; infiltration; infiltration-exfiltration test; pipe; pressure test; sewers; stand pipe; testing; test rate; test section; test time; vitrified clay pipe; water test

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