



Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated¹

This standard is issued under the fixed designation C 700; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification establishes the criteria for acceptance, prior to installation, of extra strength and standard strength vitrified clay pipe and fittings to be used for the conveyance of sewage, industrial wastes, and storm water; and extra strength perforated and standard strength perforated vitrified clay pipe to be used for underdrainage, filter fields, leaching fields, and similar subdrainage installations.

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

NOTE 1—Attention is called to Specification C 425, Test Method C 828, Test Method C 1091, Test Methods C 301, and Terminology C 896.

1.3 The following precautionary caveat pertains only to the Test Method portion, 5.2-5.2.3.2 of this standard: *This standard does not purport to address all of the safety concerns, 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 301 Test Methods for Vitrified Clay Pipe²
- C 425 Specification for Compression Joints for Vitrified Clay Pipe and Fittings²
- C 828 Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines²
- C 896 Terminology Relating to Clay Products²
- C 1091 Test Method for Hydrostatic Infiltration and Exfiltration Testing of Vitrified Clay Pipe Lines²
- IEEE/ASTM SI 10 Standard for Use of the International

System of Units (SI): The Modern Metric System³

3. Terminology

3.1 *Definitions*—Clay, fire clay, shale, and surface clay are as defined in Terminology C 896.

4. Materials and Manufacture

4.1 Vitrified clay pipe shall be manufactured from fire clay, shale, surface clay, or a combination of these materials that, when formed into pipe and fired to suitable temperatures, yields a product that conforms to this specification.

5. Physical Properties

5.1 Bearing Strength:

5.1.1 Pipe shall meet the bearing strength requirements of Table 1.

5.1.2 The number of specimens to be tested shall not exceed 0.5 % of the number of pipe of each size furnished, except that no less than two specimens shall be tested.

5.1.3 If any of the test specimens fail to meet the requirements, the manufacturer will be allowed a retest on two additional specimens for each one that failed. The pipe will be acceptable if all the retest specimens meet the test requirement.

5.1.4 If, subsequent to an initial pipe strength failure, the accuracy of the testing equipment is questioned, at the request of the manufacturer, the equipment shall be recalibrated and a retest made or a retest made upon equipment of known accuracy.

5.2 Hydrostatic Pressure Test or Absorption Test:

5.2.1 The manufacturer shall at his option, apply either a hydrostatic pressure test or an absorption test to all of the test specimens in each size and run of the pipe.

5.2.2 Hydrostatic Pressure Test:

5.2.2.1 When the pipe is subjected to an internal hydrostatic pressure of 10 psi (68.9 KPa) for the elapsed time shown in the following table, there shall be no leaking on the exterior of the pipe. Moisture appearing on the surface of the pipe in the form

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

³ *Annual Book of ASTM Standards*, Vol 14.02.

TABLE 1 Minimum Strength (3-Edge Bearing)

Nominal Size, in. (mm)	Extra Strength Vitrified Clay Pipe		Standard Strength Vitrified Clay Pipe		Perforated Vitrified Clay Pipe			
					Extra Strength		Standard Strength	
	lbf/linear ft	kN/linear m	lbf/linear ft	kN/linear m	lbf/linear ft	kN/linear m	lbf/linear ft	kN/linear m
3 (75)	2000	29.2	...	...	...	...	...	...
4 (100)	2000	29.2	1200	17.5	1250	18.2	1000	14.6
6 (150)	2000	29.2	1200	17.5	1600	23.4	1000	14.6
8 (205)	2200	32.1	1400	20.4	1600	23.4	1000	14.6
10 (255)	2400	35.0	1600	23.4	1600	23.4	1100	16.1
12 (305)	2600	37.9	1800	26.3	1800	26.3	1200	17.5
15 (380)	2900	42.3	2000	29.2	2200	32.1	1400	20.4
18 (455)	3300	48.2	2200	32.1	2640	38.5	1700	24.8
21 (535)	3850	56.2	2400	35.0	3100	45.2	2000	29.2
24 (610)	4400	64.2	2600	37.9	3520	51.4	2400	35.0
27 (685)	4700	68.6	2800	40.9	...	...	...	...
30 (760)	5000	73.0	3300	48.2	...	...	...	...
33 (840)	5500	80.3	3600	52.2	...	...	...	...
36 (915)	6000	87.6	4000	58.4	...	...	...	...
39 (990)	6600	96.3	...	...	...	...	...	...
42 (1065)	7000	102.2	...	...	...	...	...	...
48 (1220)	8000	116.7	...	...	...	...	...	...

of beads adhering to the surface shall not be considered leakage. However, moisture which starts to run on the pipe shall be construed as leakage regardless of quantity.

Hydrostatic Pressure Test Time	
Thickness of Barrel in. (mm)	Test Time (min.)
Up to and including 1 (25)	7
Over 1 (25) including 1½ (40)	9
Over 1½ (40) including 2 (50)	12
Over 2 (50) including 2½ (65)	15
Over 2½ (65) including 3 (75)	18
Over 3 (75)	21

5.2.2.2 If any of the test specimens fail to meet the Hydrostatic Pressure Test requirements, a retest will be allowed and the pipe accepted as provided in 5.1.3.

5.2.3 Absorption Test:

5.2.3.1 The absorption of vitrified clay pipe shall not exceed 8%.

5.2.3.2 If any of the test specimens fail to meet the absorption requirements, a retest will be allowed and the pipe accepted as provided in 5.1.3.

5.3 Acid Resistance:

5.3.1 This test is used to determine the resistance of pipe to the action of acids encountered in sanitary sewers. The test shall be performed only when specified.

5.3.2 The pipe of each size and shipment shall be acceptable if the acid-soluble matter, from specimens representing such pipe, does not exceed 0.25 %.

5.3.3 If any of the tests specimens fail to meet the acid resistance requirements, a retest, representative of the original material lot, in that particular acid will be allowed and the pipe accepted as provided in 5.1.3.

6. Allowable Limits for Dimensional Variation

6.1 Sizes and dimensions of pipe are as described in Table 2.

6.2 The inside diameter shall not vary from a true circle by more than 3 % of its nominal diameter.

6.3 The average inside diameter shall be determined by taking any two 90° (1.6-rad) opposing measurements and

TABLE 2 Available Limits for Dimensional Variation

Nominal Size, in. (mm) ^A	Laying Length Limit of Minus Variation, in./ft (mm/m)	Difference in Length of Two Opposite Sides Max, in. (mm)	Limit of Minus Variations from Nominal Size in Average Inside Diameter, in. (mm)
3 (75)	¼ (21)	⅝ (8)	⅜ (5)
4 (100)	¼ (21)	⅝ (8)	⅜ (5)
6 (150)	¼ (21)	⅜ (10)	⅜ (6)
8 (205)	¼ (21)	⅞ (11)	⅝ (8)
10 (255)	¼ (21)	⅞ (11)	⅜ (10)
12 (305)	¼ (21)	⅞ (11)	⅞ (11)
15 (380)	¼ (21)	½ (13)	⅞ (14)
18 (455)	¼ (21)	½ (13)	1⅜ (17)
21 (535)	⅜ (31)	⅞ (14)	1⅜ (21)
24 (610)	⅜ (31)	⅞ (14)	1⅝ (24)
27 (685)	⅜ (31)	⅝ (16)	1⅜ (30)
30 (760)	⅜ (31)	⅝ (16)	1⅜ (30)
33 (840)	⅜ (31)	⅝ (16)	1⅜ (33)
36 (915)	⅜ (31)	1⅜ (17)	1⅜ (37)
39 (990)	⅜ (31)	¾ (19)	1⅜ (37)
42 (1065)	⅜ (31)	⅞ (22)	1⅜ (37)
48 (1220)	⅜ (31)	⅞ (22)	1⅜ (37)

^A Specifiers should be aware that all pipe sizes are not universally available.

averaging the readings.

7. Straightness

7.1 Pipe shall not deviate from straight by more than $\frac{1}{16}$ in./ft (5 mm/m) of length when the maximum offset is measured from the concave side of the pipe.

7.2 Measurement shall be taken by placing a straightedge on the concave side of the full length of the pipe barrel, excluding the spigot joint material or socket, and measuring the maximum distance between the straightedge and concave side of the pipe.

8. Glaze

8.1 Unless otherwise specified, the manufacturer shall supply either glazed or unglazed pipe. On glazed pipe, the glaze shall be a continuously uniform layer that is substantially free of imperfections. Not more than 10 % of the inner surface of any pipe barrel may be free of glaze. There shall be no well defined crazing or hairline cracks.

8.2 Glazing is not required on the outer surface of the pipe at the spigot, for a longitudinal distance equal to the depth of the socket. Glaze is not required on the inside of the socket.

8.3 When a ceramic glaze is used, it need only be applied to the inside of the pipe.

9. Blisters

9.1 Pipe of nominal sizes from 3 in. (75 mm) to 18 in. (455 mm), shall have no blister with a dimension exceeding 3 in. (75 mm), and no blister or pimple shall project more than $\frac{1}{8}$ in. (3 mm) above the surface of the pipe.

9.2 Pipe of nominal sizes over 18 in. (455 mm), shall have no blister exceeding 2 in./ft (165 mm/m) of internal diameter, and no blister or pimple shall project above the surface of the pipe more than $\frac{1}{8}$ in./ft (10 mm/m) of internal diameter.

9.3 Pipe shall have no broken blisters.

10. Fractures and Cracks

10.1 There shall be no fractures or cracks visible to the unaided eye passing through the barrel or socket, except that a single crack at the spigot end of the pipe not exceeding 75 % of the depth of the socket, or a single fracture in the socket not exceeding 3 in. (75 mm) around the circumference nor 2 in. (50 mm) lengthwise is permitted.

10.2 Chips or fractures on the interior of the pipe shall not exceed 2 in. (50 mm) in length, 1 in. (25 mm) in width, and a depth of one fourth of the thickness of the barrel.

11. Finish of Ends

11.1 The ends of pipe shall be square with their longitudinal axes, within the tolerances provided in Table 2.

12. Perforations

12.1 Perforations shall be circular and cleanly cut, $\frac{1}{4}$ in. (6 mm) in diameter, arranged $3 \pm \frac{1}{4}$ in. (75 ± 6 mm) center to center in rows parallel to the longitudinal axis of the pipe. Rows shall be arranged in two equal groups on each side of the vertical center line of the pipe. The lowermost rows of perforations shall be separated by an arc of 90° (1.6 rad) measured across the bottom of the pipe. The uppermost rows of

perforations shall be separated by an arc of 200° (3.5 rad), measured across the top of the pipe. Spacing of rows between these limits shall be uniform. The total number of rows of perforations for 4, 6, and 8-in. (100, 150, and 205-mm) pipe shall be 4; for 10, 12, and 15-in. (255, 305, and 380-mm) pipe shall be 6; and for 18, 21, and 24-in. (455, 535, and 610-mm) shall be 8.

12.2 The spigot end of bell-and-spigot perforated pipe shall not be perforated for a distance equal to the depth of the socket.

13. Fittings

13.1 Fittings shall correspond in all respects with the dimensions specified for pipe of the corresponding size. Dimensional tolerances of fittings shall be the same as for straight pipe. All fittings shall conform to the requirements for pipe described in Sections 9-11.

13.2 Slants shall have their spigot ends cut at an angle of approximately 60° (1.0 rad) or 45° (0.8 rad) with the longitudinal axis.

13.3 Curves shall have arcs of approximately 90° (1.6 rad), 45° (0.8 rad), 30° (0.5 rad), or 22.5° (0.4 rad) as required.

13.4 Fittings shall be made to such lengths as will accommodate the jointing system provided. Tee and wye fittings shall be furnished with spurs of the size specified, securely and completely fastened to the barrel of the fitting in the process of manufacture. The spurs of tee fittings shall have their axes perpendicular to the longitudinal axis of the fitting. The spur of the wye fittings shall have their axes at angles of approximately 60° (1.0 rad), or 45° (0.8 rad) to the longitudinal axis of the fitting, measured from the socket or bell end of the fitting. The barrel of each spur shall be of sufficient length to permit making a proper joint.

13.5 Channel pipe and channel fittings shall be approximate half sections of the corresponding size of straight pipe and fittings.

14. Test Methods

14.1 Perform tests in accordance with Test Methods C 301.

15. Inspection

15.1 All pipe shall be subject to inspection by a competent inspector employed by the purchaser. Inspection shall be made promptly at the factory or at the point of delivery. Rejected pipe shall not be defaced, but shall be replaced by the manufacturer or seller without additional cost, with pipe that meets the requirements of this specification.

16. Product Marking

16.1 Each length of pipe shall bear the initials or name of the manufacturer, and the location of the plant. The words "Extra Strength" or the symbol "ES" shall be included, when applicable, to identify the class of pipe. The markings shall be indented on the exterior of the pipe and shall be plainly legible for identification. The markings shall be indented on the exterior of the pipe or permanently marked by other means at the time of manufacture. All markings shall be clearly legible to meet the identification requirements.

17. Keywords

17.1 absorption test; bearing strength; bell; chemical resistance; clay; corrosion resistance; drains; fittings; glaze; inspection; leaching fields; perforated; pipe; plain end; pressure test; sewers; spigot; test; vitrified

SUPPLEMENTARY REQUIREMENTS

These requirements apply only to Federal/Military procurement, not domestic sales or transfers.

S1. Government/Military Procurement

S1.1 *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1.1—In U.S. Federal contracts, the contractor is responsible for inspection.

S2. Packaging and Marking for U.S. Government Procurement

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2.1—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this document.

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