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Standard Specification for
Vitrified Clay Pipe and Joints for Use in Microtunneling, Sliplining, Pipe Bursting, and Tunnels[1]

This standard is issued under the fixed designation C 1208/C 1208M; 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 specification establishes the criteria for the manufacture, quality assurance testing, inspection, installation, field acceptance testing, and product marking of vitrified clay pipe to be used in microtunneling, pilot tube microtunneling, sliplining, pipe bursting, and in casings and tunnels for the conveyance of sewage, industrial wastes, and storm water.

1.1.1 Sections 3 through 7 and 9 of this specification contain manufacturing, quality assurance testing, inspection, and product marking criteria which are applicable to vitrified clay pipe prior to installation.

1.1.2 Section 8 of this specification contains criteria for the installation and field acceptance testing of vitrified clay pipe.

1.2 This specification also covers materials and test requirements for jointing of the pipe.

1.3 The values stated in either inch-poundSI units or SIinch-pound units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system aremay not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the specification. standard.

1.4 *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:*[2]

C 67 Test Methods for Sampling and Testing Brick and Structural Clay Tile
C 301 Test Methods for Vitrified Clay Pipe
C 828 Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines
C 896 Terminology Relating to Clay Products
C 1091 Test Method for Hydrostatic Infiltration and Exfiltration Testing of Vitrified Clay Pipe Lines
D 395 Test Methods for Rubber Property—Compression Set
D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension Test Methods for Vulcanized Rubber and Thermoplastic ElastomersTension
D 471 Test Method for Rubber Property—Effect of Liquids
D 518 Test Method for Rubber Deterioration—Surface Cracking
D 543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents
D 573 Test Method for Rubber—Deterioration in an Air Oven
D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber Test Methods for Rubber Deterioration Cracking in an Ozone Controlled Environment
D 2240 Test Method for Rubber Property—Durometer Hardness

3. Terminology

3.1 *Definitions*— Terminology C 896 can be used for clarification of terminology in this specification.

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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.

4.2 *Test Requirements for Pipe* :

4.2.1 *Test Samples*:

4.2.1.1 When requested, test samples representative of the pipe to be used shall be selected by the purchaser or his representative from the supplier's stock.

4.2.1.2 The number of samples to be tested shall not exceed 0.5 % of the number of pipe of each size furnished, except that no less than three samples shall be tested.

4.2.1.3 If any of the test samples fail to meet the requirements of 4.2.2 through 4.2.5, the manufacturer will be allowed to retest two additional samples representative of the original material for each one that failed. The pipe will be acceptable if all retest samples meet the test requirements. If any of the re-test pipe fail, the lot shall be rejected.

4.2.1.4 If, subsequent to an initial test 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 using other equipment of known accuracy.

4.2.2 *Bearing Strength— Pipe*:

4.2.2.1 Pipe shall meet the bearing strength requirements of Table 1 or Table 2.

4.2.2.2 The manufacturer may test and certify pipe to higher bearing strengths than listed in Table 1 and Table 2.

4.2.3 *Compressive Strength Test*:

4.2.3.1 This test is used to determine the compressive strength of pipe material. This test shall be performed only when specified.

4.2.3.2 Pipe material shall have a minimum compressive strength of 7000 psi [48 MPa].

4.2.3.3 The testing machine shall be of a type having sufficient capacity and capable of providing the rates of loading prescribed. The bearing area from which the force will be applied shall be spherically seated.

4.2.3.4 The specimen shall be a cylinder cut from the pipe so that the length of the specimen is along the longitudinal axis of the pipe. The cylinder shall have a minimum diameter of 1 in. (25 mm)[25 mm] for pipe wall thicknesses through 2 1/2½ in. (64 mm)[64 mm] and 2 in. (51 mm)[51 mm] for greater wall thicknesses and a diameter to length ratio of 1:1. The tolerance of the diameter and length shall be + 10 % – 0 %. Measurements shall be made to the nearest 0.001 in. (0.025 mm). [0.025 mm].

4.2.3.5 The test load on the specimen shall be centered axially on the ends of the cylinder.

4.2.3.6 The bearing surfaces of the specimen shall be parallel planes and perpendicular to the vertical axis.

4.2.3.7 The bearing surface of the test samples shall be ground to planes, parallel within 0.002 in. (0.05 mm).[0.05 mm]. The use of capping material is not permitted.

4.2.3.8 Apply the load up to 3500 psi [24 MPa]. The remaining required load is applied at the uniform rate in not less than 1 min nor more than 2 min.

4.2.3.9 Calculate and report the compressive strength as follows:

$$\text{Compressive Strength, } C = W/A \tag{1}$$

where:

C = compressive strength of the specimen, psi (kPa)[kPa] to the nearest 100 psi [690 kPa],
W = recorded load, lbf [kgf/mm^2], indicated by the testing machine, and
A = average of the gross areas of the upper and lower bearing surfaces of the specimen, in.^{2} [mm^2] to the nearest 0.04 in.^{2}[26 mm^2].

4.2.4 *Hydrostatic Pressure Test or Absorption Test*:

TABLE 1 Three Edge Bearing Strength

Nominal Diameter, in.	Bearing Strength, lb/linear ft
4	2000
6	2000
8	2200
10	2400
12	2600
15	2900
18	3300
21	3850
24	4400
27	4700
30	5000
36	6000
42	7000
48	8000

TABLE 2 Three Edge Bearing Strength [SI]

Nominal Diameter, mm	Bearing Strength, kN/m
100	29
150	29
200	32
250	35
300	38
400	42
500	52
600	64
700	69
800	77
900	88
1000	96
1100	105
1200	120

TABLE 3 Hydrostatic Pressure Test Time

Barrel Thickness, in.	Test Time, min
Up to and including 1	7
Over 1 including 1.5	9
Over 1.5 including 2	12
Over 2 including 2.5	15
Over 2.5 including 3	18
Over 3	21

TABLE 4 Hydrostatic Pressure Test Time [SI]

Barrel Thickness, mm	Test Time, min
Up to and including 25	7
Over 25 including 38	9
Over 38 including 50	12
Over 50 including 64	15
Over 64 including 76	18
Over 76	21

4.2.4.1 The manufacturer shall, at his option, apply either a hydrostatic pressure test or an absorption test to all of the test specimens.

4.2.4.2 *Hydrostatic Pressure Test*—When the pipe is subjected to an internal hydrostatic pressure of 10 psi [69 kPa] for the elapsed time indicated in Tables 3 and 4, there shall be no leakage. Moisture appearing on the surface shall not be considered leakage. However, moisture which starts to run on the pipe shall be construed as leakage, regardless of quantity. At the option of the manufacturer, water within approximately 5°F [3°C] of the ambient air temperature may be introduced into the pipe for control of condensation.

4.2.4.3 *Absorption Test*—The absorption of vitrified clay pipe shall not exceed 8 % when tested in accordance with Test Methods C 301.

4.2.5 *Acid Resistance*:

4.2.5.1 This test is used to determine the resistance of pipe to the action of acids specified in Test Methods C 301. The test shall be performed only when specified.

4.2.5.2 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 %.

4.3 *Sizes and Dimensions*:

4.3.1 Sizes and dimensions of pipe shall conform to the requirements of Table 5 or Table 6.

4.3.2 The outside diameter shall not vary from a true circle by more than 2 % of its nominal diameter.

4.3.2.1 The out-of-round dimension is the difference between the maximum and minimum diameters measured at any one location along the pipe barrel.

4.3.3 Pipe shall not deviate from straight by more than 0.05 in./linear ft [4 mm/m] when the maximum offset is measured from the concave side of the pipe. See Fig. 1.

4.3.3.1 Measurements shall be taken by placing a straightedge on the concave side of the full length of the pipe barrel excluding the joint and measuring the maximum distance between the straightedge and concave side of the pipe.

4.3.4 The plane formed by a pipe end shall not deviate by more than 0.005 in./in. [0.005 mm/mm] of outside diameter when measured in accordance with Fig. 1.

4.3.5 The pipe wall thickness shall be a suitable dimension to adequately distribute the field jacking forces and shall be prescribed by the manufacturer.

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TABLE 5 Dimensions and Variations

Nominal Diameter, in.	Out-of-Straight[A], in./linear ft, max	Out-of-Round, in., max	Out-of-Square[A], in., max[B]	Laying Length Minus Tolerance, in./linear ft	Nominal Inside Diameter Minus Tolerance[C], in.
4	0.05	0.08	0.03	0.25	0.19
6	0.05	0.12	0.04	0.25	0.25
8	0.05	0.16	0.05	0.25	0.31
10	0.05	0.20	0.06	0.25	0.38
12	0.05	0.24	0.08	0.25	0.44
15	0.05	0.30	0.09	0.25	0.56
18	0.05	0.36	0.11	0.25	0.69
21	0.05	0.42	0.13	0.25	0.81
24	0.05	0.48	0.15	0.38	0.94
27	0.05	0.54	0.17	0.38	1.06
30	0.05	0.60	0.19	0.38	1.19
36	0.05	0.72	0.22	0.38	1.44
42	0.05	0.84	0.25	0.38	1.44
48	0.05	0.96	0.28	0.38	1.44

[A] See Fig. 1.
[B] These numbers are approximate since they are computed using outside diameter. Consult the pipe manufacturer for specific dimensions.
[C] There is no fixed + tolerance limit.

TABLE 6 Dimensions and Variations [SI]

Nominal Diameter, mm	Out-of-Straight[A], mm/M, max	Out-of-Round, mm, max	Out-of-Square[A], mm, max[B]	Laying Length Minus Tolerance, mm/M	Nominal Inside Diameter Minus Tolerance[C], mm
100	4	2	1	20	5
150	4	3	1	20	6
200	4	4	1	20	8
250	4	5	1	20	10
300	4	6	2	20	12
400	4	8	2	20	16
500	4	10	3	20	20
600	4	12	3	30	24
700	4	14	4	30	28
800	4	16	4	30	32
900	4	18	5	30	36
1000	4	20	5	30	36
1100	4	22	6	30	36
1200	4	24	7	30	36

[A] See Fig. 1.
[B] These numbers are approximate since they are computed using outside diameter. Consult the pipe manufacturer for specific dimensions.
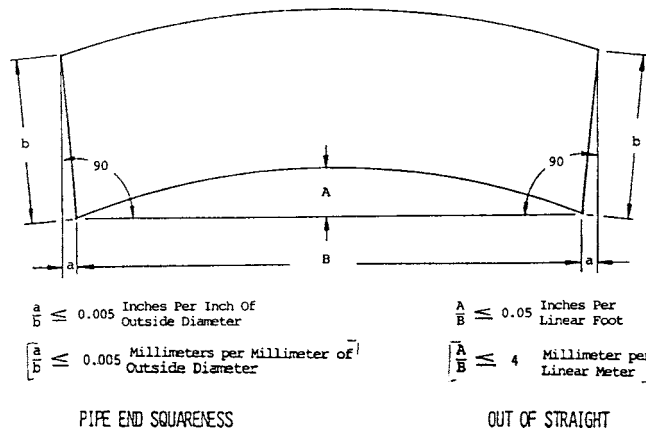[C] There is no fixed + tolerance limit.

$\dfrac{a}{b} \leqq 0.005$ Inches Per Inch Of Outside Diameter $\dfrac{A}{B} \leqq 0.05$ Inches Per Linear Foot

$\dfrac{a}{b} \leqq 0.005$ Millimeters per Millimeter of Outside Diameter $\dfrac{A}{B} \leqq 4$ Millimeter per Linear Meter

PIPE END SQUARENESS   OUT OF STRAIGHT

Note 1—Illustration is exaggerated to show dimensions.
FIG. 1 Pipe End Squareness and Out of Straight

4.4 *Fractures, Cracks, and Blisters* :

4.4.1 There shall be no fractures or cracks passing through the barrel, visible to the unaided eye.

4.4.2 Chips, fractures, or blisters on the pipe shall not exceed 2 in. [51 mm] in any surface dimension and shall not exceed a depth of one eighth of the minimum thickness of the barrel.