Designation: C1208/C1208M – 18 (Reapproved 2022)

# 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 C1208/C1208M; 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 jacking pipe to be used in microtunneling, the pilot tube method, 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 SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may 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 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

C67/C67M Test Methods for Sampling and Testing Brick and Structural Clay Tile

C301 Test Methods for Vitrified Clay Pipe

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

C896 Terminology Relating to Clay Products

C1091 Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines

D395 Test Methods for Rubber Property—Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

D518 Test Method for Rubber Deterioration—Surface Cracking (Withdrawn 2007)[3]

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D573 Test Method for Rubber—Deterioration in an Air Oven

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

D2240 Test Method for Rubber Property—Durometer Hardness

## 3. Terminology

3.1 *Definitions*—Terminology C896 can be used for clarification of terminology in this specification.

## PIPE

## 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.

[1] This specification 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] 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.

4.2 *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 4.2.6, 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:*

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 parallel with the longitudinal axis of the pipe. The cylinder shall have a minimum diameter of 0.75 in. [19 mm] for pipe wall thicknesses through 2½ in. [64 mm] and 2 in. [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 0.01 in. [0.25 mm].

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

**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 |

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]. To ensure a uniform bearing of the sample, place between two plywood sheets. The plywood shall be three-ply, ranging from 0.19 in. [4 mm] to 0.25 in. [6 mm] thick, made of soft wood and free from knots. The plywood shall exceed the specimen diameter by 0.50 in. [13 mm] to 1.50 in. [38 mm]. Use a fresh pair of plywood sheets for each test.

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:

$$\text{Compressive Strength, } C = W/A \quad (1)$$

where:

$C$ = compressive strength of the specimen, psi [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 *Jacking Load:*

4.2.4.1 The pipes jacking strength is calculated from the minimum cross sectional area multiplied by the compressive strength requirement of 4.2.3.2. The maximum allowable jacking load shall be calculated by dividing the pipes jacking strength by the specified factor of safety as determined by the engineer.

4.2.5 *Hydrostatic Pressure Test or Absorption Test:*

**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 |

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

4.2.5.2 *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.

4.2.5.3 *Absorption Test*—The absorption of vitrified clay pipe shall not exceed 8 % when tested in accordance with Test Methods C301.

4.2.6 *Acid Resistance:*

4.2.6.1 This test is used to determine the resistance of pipe to the action of acids encountered in sanitary sewers. Test results shall be provided when requested.

4.2.6.2 Test specimens shall be representative of the material of the pipe supplied.

4.2.6.3 The loss of material from the test specimen shall not exceed 0.25 %.

4.2.6.4 The test shall be in accordance with Test Methods C301.

4.2.6.5 If any of the test specimens fail to meet the acid resistance requirements, the manufacturer will be allowed to retest two additional specimens. The pipe will be acceptable if all retest specimens meet the test requirements.

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 average inside diameter shall be determined by taking any two 90° (1.6-rad) opposing measurements and averaging the readings.

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

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

4.3.4 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.

4.3.4.1 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.

4.3.5 The end squareness measured at the pipe ends shall not deviate by more than 0.005 in./in. [0.005 mm/mm] of outside diameter to a maximum of 0.10 in. [2.5 mm] when measured in accordance with Fig. 1.

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.

## JOINTS

### 5. Materials and Manufacture

5.1 *Principles of Joint Design:*

5.1.1 A typical joint design is indicated in Fig. 2.

5.1.2 Sealing elements shall be compressed between bearing surfaces to ensure watertight integrity as required in 5.3.

5.1.3 Sealing elements may be independent or bonded to a bearing surface.

**TABLE 5 Dimensions and Variations**

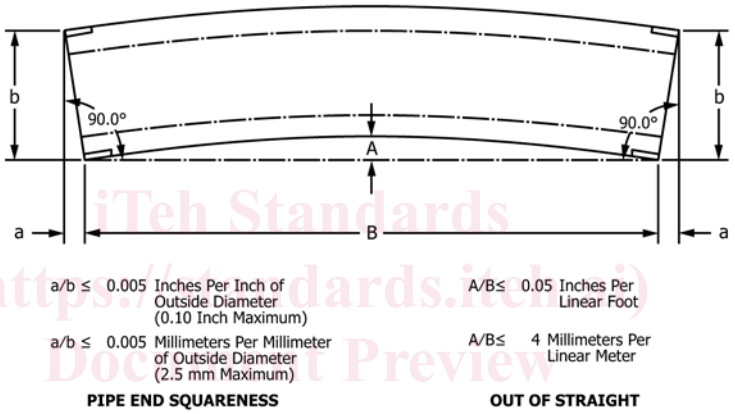
| Nominal Diameter, in. | Out-of-Straight[A], in./linear ft, max | Out-of-Round, in., max | Out-of-Square[A], in., max[B] | Laying Length Minus Tolerance, in./linear ft | Nominal Inside Diameter Minus Tolerance[C], in. |
|---|---|---|---|---|---|
| 4 | 0.05 | 0.08 | 0.03 | 0.25 | 0.19 |
| 6 | 0.05 | 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 | 0.10 | 0.25 | 0.69 |
| 21 | 0.05 | 0.42 | 0.10 | 0.25 | 0.81 |
| 24 | 0.05 | 0.48 | 0.10 | 0.38 | 0.94 |
| 27 | 0.05 | 0.54 | 0.10 | 0.38 | 1.06 |
| 30 | 0.05 | 0.60 | 0.10 | 0.38 | 1.19 |
| 36 | 0.05 | 0.72 | 0.10 | 0.38 | 1.44 |
| 42 | 0.05 | 0.84 | 0.10 | 0.38 | 1.44 |
| 48 | 0.05 | 0.96 | 0.10 | 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 | 0.5 | 20 | 5 |
| 150 | 4 | 3 | 0.75 | 20 | 6 |
| 200 | 4 | 4 | 1.0 | 20 | 8 |
| 250 | 4 | 5 | 1.25 | 20 | 10 |
| 300 | 4 | 6 | 1.5 | 20 | 12 |
| 400 | 4 | 8 | 2.0 | 20 | 16 |
| 500 | 4 | 10 | 2.5 | 20 | 20 |
| 600 | 4 | 12 | 2.5 | 30 | 24 |
| 700 | 4 | 14 | 2.5 | 30 | 28 |
| 800 | 4 | 16 | 2.5 | 30 | 32 |
| 900 | 4 | 18 | 2.5 | 30 | 36 |
| 1000 | 4 | 20 | 2.5 | 30 | 36 |
| 1100 | 4 | 22 | 2.5 | 30 | 36 |
| 1200 | 4 | 24 | 2.5 | 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.






NOTE 1—Illustration is exaggerated to show dimensions.

**FIG. 1 Pipe End Squareness and Out of Straight**



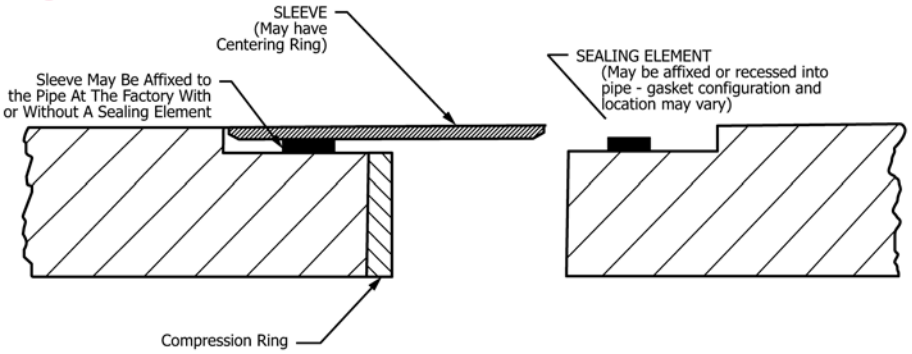



**FIG. 2 Typical Joint Design**

5.1.4 The ends of the pipe shall incorporate a compression ring to distribute the jacking forces which develop during installation.

5.1.5 The outside diameter of the sleeve shall not vary from the outside diameter of the pipe barrel to the extent that it would restrict the installation during jacking.

5.2 *Requirements:*

5.2.1 Sealing components shall meet the requirements of Table 7.

5.2.2 Sleeves shall be made of a material which in conjunction with the sealing elements, forms a joint which meets the test requirements of 5.3.

5.3 *Test Requirements for Assembled Joints:*