



# Standard Specification for Non-Asbestos Fiber-Cement Nonpressure Sewer Pipe<sup>1</sup>

This standard is issued under the fixed designation C 1449; 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 covers requirements relating to non-asbestos fiber-cement non-pressure sewer pipe, joints, and fittings suitable for use with gravity flow, intended for sewerage and drainage applications from point of use to point of treatment or disposal. It defines certain conditions of manufacture, classification, characteristics, and acceptance tests applicable to these products.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

NOTE 1—Rubber rings suitable for use with this pipe are covered in Specification D 1869.

NOTE 2—This specification is issued for product standardization and purchasing purposes only, and does not include requirements for installation or the relationships between operating conditions and the strength characteristics of the various classifications of pipe. The purchaser is cautioned that he must correlate installation and operating conditions with the specified characteristics of the pipe.

1.3 *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 150 Specification for Portland Cement<sup>2</sup>

C 500 Test Methods for Asbestos-cement Pipe<sup>3</sup>

C 595 Specification for Blended Hydraulic Cements<sup>2</sup>

C 1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products<sup>4</sup>

D 1869 Specification for Rubber Rings for Asbestos-cement Pipe<sup>3</sup>

### 2.2 Federal Standard:

No. 123 Marking for Domestic Shipment (Civilian Agencies)<sup>5</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-17 on Fiber-Cement Products and is the direct responsibility of Subcommittee C17.02 on Non-Asbestos Fiber-Cement Products.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 09.02.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.05.

<sup>5</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

### 2.3 Military Standard:

No. 129 Marking for Shipment and Storage<sup>5</sup>

### 2.4 Other Standards:

Uniform Freight Classification Rules<sup>6</sup>

National Motor Freight Classification Rules<sup>7</sup>

## 3. Terminology

3.1 *Definitions*—Refer to Terminology C 1154.

3.1.1 *coupling*—section for joining fiber-cement non-pressure sewer pipe, as defined in 5.3, that when properly installed with the proper accessories, develops an assembled joint, equivalent in serviceability and strength to the pipe sections when tested in accordance with 7.3.

3.1.2 *fitting*—components such as wyes, tees, adaptors, for use in laying fiber-cement pipe, such that, when properly installed, yields develops an assembly fitting equivalent in serviceability and strength to the pipe sections.

3.1.3 *pipe*—fiber-cement non-pressure sewer pipe as defined in Sections 1, 3, and 5.

### 3.2 Lot:

3.2.1 A lot is used herein for designated pipe sizes 150 mm (6 in.) and smaller is defined as those lengths of pipe of that size, class, and type manufactured during the same shift.

3.2.2 A lot, used herein for designated pipe sizes 200 mm (8 in.) through 525 mm (21 in.), is defined as each 300 lengths of pipe or less, of identical size, class, and type manufactured on each machine during a 24-h period.

3.2.3 A lot, used herein for designated pipe sizes larger than 525 mm (21 in.), is defined as each 300 lengths of pipe or less, of identical size, class, and type manufactured on each machine during a period of consecutive working days not exceeding seven days.

## 4. Classification

4.1 Fiber-cement pipe furnished under this specification shall be designated as Classes 1500, 2400, 3300, 4000, 5000, 6000, and 7000 based on the respective crushing strengths, and shall be furnished in the designated sizes as shown in Table 1.

4.2 The type of pipe shall be designated as Type I or Type II in accordance with the chemical requirements of Section 6.

NOTE 3—To assist the purchaser in choosing the type of pipe most

<sup>6</sup> Available from the Uniform Classification Commission, Room 1106, 222 S. Riverside Plaza, Chicago, IL 60606.

<sup>7</sup> Available from National Motor Freight Inc., 1616 P St., NW, Washington, DC 20036.

**TABLE 1 Designated Sizes of Pipes According to Classes**

Designated Size, mm (in.)	Classes <sup>A</sup>						
	1500	2400	3300	4000	5000	6000	7000
100 (4)	X	X	X	...	...	...	...
125 (5)	X	X	X	...	...	...	...
150 (6)	X	X	X	...	...	...	...
200 (8)	X	X	X	...	...	...	...
250 (10)	X	X	X	X	X	...	...
300 (12)	X	X	X	X	X	...	...
350 (14)	X	X	X	X	X	...	...
375 (15)	X	X	X	X	X	...	...
400 (16)	X	X	X	X	X	...	...
450 (18)	...	X	X	X	X	X	X
500 (20)	...	X	X	X	X	X	X
525 (21)	...	X	X	X	X	X	X
600 (24)	...	X	X	X	X	X	X
675 (27)	...	...	X	X	X	X	X
750 (30)	...	...	X	X	X	X	X
825 (33)	...	...	...	X	X	X	X
900 (36)	...	...	...	X	X	X	X
975 (39)	...	...	...	X	X	X	X
1050 (42)	...	...	...	X	X	X	X

<sup>A</sup> Other classes may be available on special order.

suitable for his use, guidelines for the definitions of aggressiveness of water and of soil environments for selection of the proper type of fiber-cement pipe are covered in the appropriate sections of Test Methods C 500.

## 5. Materials and Manufacture

5.1 Fiber-cement pipes shall be composed of an intimate mixture of an inorganic hydraulic binder (see Specification C 150) or a calcium silicate binder (see Specification C 595) formed by the chemical reaction of a siliceous material and a calcareous material reinforced by organic fibers, inorganic non-asbestos fibers, or both. Process aids, fillers and pigments which are compatible with fiber-reinforced cement are not prohibited from being added.

5.2 The pipe shall be of laminar construction formed under pressure to a homogeneous structure and cured under natural or accelerated conditions to meet the chemical and physical requirements of this specification.

### 5.3 Couplings:

5.3.1 Fiber-cement non-pressure sewer couplings shall be made in conformance with 5.1 and 5.2.

5.3.2 Fiber-cement non-pressure sewer couplings shall be equivalent in serviceability to those couplings defined in 5.3.1 and shall be installed in accordance with the manufacturer's recommendations.

### 5.4 Fittings:

5.4.1 Fiber-cement non-pressure sewer fittings shall be made in conformance with 5.1 and 5.2.

5.4.2 Fiber-cement non-pressure sewer fittings shall be equivalent in serviceability to those fittings defined in 5.4.1 and shall be installed in accordance with the manufacturer's recommendations.

## 6. Chemical Composition

6.1 When tested in accordance with the appropriate sections of Test Methods C 500, the amount of uncombined calcium hydroxide shall not exceed 1.0 % for Type II pipe.

NOTE 4—There are no chemical requirements for Type I pipe.

## 7. Physical Properties

7.1 *Crushing Strength*—Crushing tests shall be conducted before shipment. A test specimen cut from an unmachined portion of the pipe shall have the minimum crushing strength prescribed in Table 2, when tested in accordance with 10.3 and the V-Shaped Bearing Method of Test Methods C 500.

7.2 *Flexural Strength*—Longitudinal bending tests shall be conducted before shipment. Each length of pipe 3 m (10 ft) or longer, for designated sizes 200 mm (8 in.) and less, shall have the minimum proof flexural strength prescribed in Table 3, when tested in accordance with the appropriate section of Test Methods C 500.

7.3 *Joint Tightness*—The tests outlined in this section are considered to be one-time qualification tests to establish the adequacy of the manufacturer's joint design. Instead of requiring performance of these tests, the purchaser may require the manufacturer to certify that pipes and couplings equivalent in material and design have passed the tests enumerated in this section. At his own expense, however, the purchaser, by designation with his order, shall have the option to require that assembled pipes and couplings pass the following performance tests without leakage.

7.3.1 *Couplings*—The couplings, when assembled on pipe, shall be capable of withstanding simultaneously:

7.3.1.1 The minimum crushing load prescribed in Table 2, when tested in accordance with Section 5 of Test Methods C 500, and

7.3.1.2 The hydrostatic pressure tests described in 7.3.1.3 and 7.3.1.4.

7.3.1.3 *Straight Alignment*—A hydrostatic pressure test shall be made on an assembly of two sections of pipe properly connected with a coupling in accordance with the joint design. An equivalent alternative shall be a single pipe with a coupling on each end. The assembly shall be subjected to an internal hydrostatic pressure of 70 kPa (10 psi) for 10 min. Any visible water leakage shall be considered failure of the test requirements.

7.3.1.4 *Maximum Deflected Position*—Upon completion of the test for pipe in straight alignment in accordance with 7.3.1.3, deflect the test sections 90 mrad (5°) for 300 mm (12 in.) and smaller diameters, 50 mrad (3°) for 350 mm (14 in.) and larger diameters (with one half of the deflection being between each pipe and the coupling). The deflected assembly shall be subjected to an internal hydrostatic pressure of 70 kPa (10 psi) for 10 min. Any visible water leakage shall be considered a failure of the test requirements.

## 8. Dimensions and Tolerances

8.1 Couplings and coupling areas of the pipe shall be machined or otherwise finished to such dimensions as will

**TABLE 2 Crushing Strength**

Class	Minimum Crushing Load, kN/m (lbf/ft)
1500	21.9 (1500)
2400	35.0 (2400)
3300	48.2 (3300)
4000	58.4 (4000)
5000	73.0 (5000)
6000	87.6 (6000)
7000	102.2 (7000)

**TABLE 3 Flexural Proof Strength**

Designated Size, mm (in.)	Total Applied Load <sup>A</sup>		
	Class 1500 kN (lbf)	Class 2400 kN (lbf)	Class 3000 kN (lbf)
100 (4)	2.4 (550)	2.4 (550)	2.4 (550)
125 (5)	4.2 (950)	4.2 (950)	4.2 (950)
150 (6)	6.7 (1500)	6.7 (1500)	6.7 (1500)
200 (8)	13.3 (2700)	17.3 (3000)	17.3 (3900)

<sup>A</sup>The indicated loads are applied over a clear span of 2.7 m (9 ft). It shall be optional to test at 75 % of the indicated loads on a clear span of 3.7 m (12 ft).

meet the joint tightness requirements defined in 7.3.

8.2 The permissible variation of the internal diameter shall be in accordance with Table 4.

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

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

## 9. Workmanship, Finish and Appearance

9.1 Ends of the pipe that receive the coupling shall be free of dents and gouges that will affect the tightness of the joint.

9.2 Each pipe shall be free of bulges, dents, and tears in the inside surface that result in a variation of more than 5 mm (0.2 in.) from that obtained on adjacent unaffected portions of the surface.

9.3 Each length of pipe shall not vary in straightness by more than the following tolerances when the variation is measured in accordance with Section 6 of Test Methods C 500.

Designated Size, mm (in.)	Tolerance, mm/m (in./ft)
100 to 150 (4 to 6)	5 (0.06)
200 to 1050 (8 to 42)	4 (0.05)

## 10. Sampling

10.1 Test all material under this specification after immersion under water at  $23 \pm 4^\circ\text{C}$  ( $73 \pm 7^\circ\text{F}$ ) for a minimum of 24 h for the crushing tests and in a normal air-dried condition in equilibrium with atmospheric humidity for the flexural tests.

**TABLE 4 Permissible Variation in Internal Diameter of Pipe**

Designated Size, mm (in.)	Average Internal Diameter	
	min mm (in.)	max mm (in.)
100 (4)	95 (3.75)	110 (4.25)
125 (5)	120 (4.75)	135 (5.25)
150 (6)	145 (5.75)	160 (6.25)
200 (8)	195 (7.75)	210 (8.25)
250 (10)	245 (9.75)	260 (10.25)
300 (12)	295 (11.75)	315 (12.25)
350 (14)	345 (13.75)	365 (14.25)
375 (15)	370 (14.75)	390 (15.25)
400 (16)	400 (15.75)	415 (16.25)
450 (18)	450 (17.75)	465 (18.25)
500 (20)	500 (19.75)	520 (20.30)
525 (21)	525 (20.69)	545 (21.31)
600 (24)	600 (23.64)	620 (24.36)
675 (27)	675 (26.60)	700 (27.40)
750 (30)	750 (29.55)	775 (30.45)
825 (33)	825 (32.51)	850 (33.49)
900 (36)	900 (35.46)	930 (36.54)
975 (39)	975 (38.42)	1010 (39.80)
1050 (42)	1050 (41.37)	1085 (42.63)

NOTE 5—When sampling from continuous production, these tests may be conducted on dry, equilibrium, or saturated specimens, provided a relationship can be established between this testing and the specified values.

10.2 Each length of pipe 3 m (10 ft) or longer in designated sizes 200 mm (8 in.) or less shall be tested in flexure by the manufacturer prior to shipment in accordance with Section 4 of Test Methods C 500.

10.3 For crushing tests of designated pipe sizes 150 mm (6 in.) and smaller, one length of pipe shall be selected from each 500 lengths of 3 and 4 m (10 and 13 ft) lengths and each 1000 lengths of 1.5 and 2.0 m (5 and 6.5 ft) lengths of each size, class, and type of pipe covered by the order.

10.3.1 For designated pipe sizes 8 in. (200 mm) and larger, one length of pipe shall be selected from each lot of each size, class, and type of pipe covered by the order.

10.3.2 In either case, one test specimen 300 mm (12 in.) long shall be cut from the unmachined portion of the selected length of pipe. (**Warning**—In addition to other precautions, when cutting fiber-cement products minimize the dust that results. Prolonged or frequent breathing of significant airborne concentrations of silica dust is hazardous. When such dusts are generated, effective measures shall be taken to prevent inhalation. See approved techniques.<sup>6</sup>)

10.4 When uncombined calcium hydroxide tests are requested in 6.1, take one sample from each lot of pipe. Take the sample to be tested from any one of the specimens selected for the crushing test.

## 11. Inspection

11.1 All material furnished under this specification shall conform to the requirements stated herein and shall be subjected to the factory inspection and tests prescribed in this specification. When requested by the purchaser on his order, the manufacturer shall notify the purchaser of the time that the inspection and testing will take place so that the purchaser may arrange for witnessing such tests and inspections at his own expense. Instead of inspection, when requested, the manufacturer shall certify that his product conforms to the requirements of this standard.

11.2 Pipe and coupling shall be inspected by the manufacturer, before shipment, for compliance with the standards for dimensions, tolerances, and workmanship and finish (see Section 9).

## 12. Rejection and Rehearing

12.1 Failure of any specimen tested for crushing strength to withstand 75 % of the load specified in 7.2 shall be cause for rejection of the lot from which the test specimen was taken. When any specimen tested for crushing strength withstands over 75 % but under 100 % of the load specified in 7.1, one specimen shall be cut from each of two additional pipes of the same lot. Failure of either of these additional pipes to meet the strength requirements of 7.1 shall be cause for rejection of the entire lot from which the original sample was taken.

12.2 If the results of the uncombined calcium hydroxide test show the sample failed to meet the specification requirements, two additional specimens shall be selected and sampled for test. The failure of one of these two additional samples to meet

the specification requirements of 6.1 shall be cause for rejection of the lot.

12.3 Material that fails to conform to the requirements of this specification constitutes grounds for rejection. Rejection shall be reported to the producer or supplier promptly in writing. In case of disagreement with the results of the test, either the producer or supplier is able to make claim for a rehearing.

### 13. Marking and Shipping

13.1 Each length of pipe, 3 m (10 ft) or longer for designated sizes 200 mm (8 in.) or larger, 1.5 m (5 ft) or longer

for designated sizes 100 through 150 mm (4 through 6 in.) shall be marked by the manufacturer with the trade name, designated size, class, type, and the date of manufacture in alkali resistant ink or indelible paint. Each coupling sleeve shall be marked by the manufacturer with the designated size, class, and type for the pipe with which it shall be used.

13.2 Pipe and couplings shall be prepared for commercial shipment to ensure acceptance by common or other carriers.

### 14. Keywords

14.1 drainage; fiber-cement; nonpressure; pipe; sewer

## SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply when material is supplied under this specification for U.S. Government procurement:

### S1. Packaging

S1.1 Unless otherwise specified in the contract, the material shall be packaged in accordance with the producer's standard practice 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. Marking for shipment of such material shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

### S2. Responsibility for Inspection

S2.1 Unless otherwise specified in the contract or purchase order, the producer is responsible for the testing of all material to ensure compliance with the requirements specified herein. Except as otherwise specified in the contract or order, the producer will use suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser. 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.

## APPENDIX

### X1. ADDITIONAL ORDERING INFORMATION

X1.1 It is suggested that information shall be included in the agreement for purchase of pipe, couplings, and fittings as follows:

X1.1.1 Any tests, in addition to those prescribed by this specification, as the special circumstances shall require,

X1.1.2 The place or places where any additional tests are to be made,

X1.1.3 Description of the additional testing facilities,

X1.1.4 Who shall bear the expense of such additional tests,

X1.1.5 Whether such additional tests shall be made by any sound sampling process or other method approved by the parties, and

X1.1.6 Whether fiber-cement non-pressure sewer couplings and fittings shall be provided.

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