



Designation: C1447/C1447M – 04 (Reapproved 2019)^{ε1}

Standard Specification for Non-Asbestos Fiber-Cement Underdrain Pipe¹

This standard is issued under the fixed designation C1447/C1447M; 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.

^{ε1} NOTE—Minor change was editorially made in October 2023.

1. Scope

1.1 This specification covers non-asbestos fiber-cement perforated and plain pipe intended for use in the conveyance of drainage water for the subsurface drainage of highways, airports, farms, foundations, and other similar drainage work.

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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

C150/C150M Specification for Portland Cement
C497 Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile

C500/C500M Test Methods for Asbestos-Cement Pipe (Withdrawn 2022)³

C595/C595M Specification for Blended Hydraulic Cements
C1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products

2.2 Federal Standard:

No. 123 Marking for Domestic Shipment (Civilian Agencies)⁴

2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage⁴

2.4 Other Standards:

Uniform Freight Classification Rules⁵

National Motor Freight Classification Rules⁶

2.5 ISO Standards⁷

ISO 390 1993 Products in Fibre Reinforced Cement— Sampling and Inspection

ISO 2859 1999 Sampling Procedures for Inspection by Attributes Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-Lot Inspection

ISO 3951 1989 Sampling Procedures and Charts for Inspection by Variables for Percent Nonconforming

3. Terminology

3.1 Definitions:

3.1.1 Refer to Terminology C1154.

3.1.2 *coupling, n*—component made from a larger diameter pipe of the same type or class, or of Type II and a higher class, or produced otherwise to yield at least equal performance, for joining fiber-cement pipe that when properly installed, forms a silt-tight joint, allows alignment corrections and slight changes in direction and provides an assembled joint equivalent in serviceability and strength to the pipe sections.

¹ This specification is under the jurisdiction of ASTM Committee C17 on Fiber-Reinforced Cement Products and is the direct responsibility of Subcommittee C17.02 on Fiber-Cement Products.

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

⁵ Available from the Uniform Classification Commission, Room 1106, 222 S. Riverside Plaza, Chicago, IL 60606.

⁶ Available from National Motor Freight Inc., 1616 P St., NW, Washington, DC 20036.

⁷ Available from International Organization for Standardization (ISO), 1 Rue de Varambe, Case Postale 56, CH-1211, Geneva 20, Switzerland.

4. Sizes and Types

4.1 Fiber-cement underdrain pipe furnished under this specification shall be known as “fiber-cement underdrain pipe.” It shall be furnished in nominal inside diameters of 4, 6, 8, 10, and 12 in. [100, 150, 200, 250, and 300 mm]. The types of pipe shall be known as Type I and Type II corresponding to the chemical requirements given in S3.

NOTE 1—To assist the purchaser in choosing the type of pipe most suitable for his use, guidelines for the definition of aggressiveness of water and of soil environments for selection of the proper type of cement pipe are covered in the appropriate sections of Test Methods **C500/C500M**.

NOTE 2—There are no chemical requirements for Type I pipe. Type II pipe is generally accepted as being unaffected by sulfates in groundwater which cause matrix expansion and consequential pipe deterioration.

5. Materials and Manufacture

5.1 Fiber-cement underdrain pipe shall be composed of an intimate mixture of an inorganic hydraulic binder (see Specification **C150/C150M**) or a calcium silicate binder (see Specification **C595/C595M**) 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. The material shall be of laminar construction, formed under pressure to a homogeneous structure, and cured to meet the physical and chemical requirements of this specification.

6. Crushing Strength

6.1 Crushing tests shall be conducted before shipment. The crushing strength test results when assessed in accordance with Section 11 (Sampling) shall comply with the specified minimum crushing strength in **Table 1**. Test Specimens 12 in. [300 mm] long cut from an unmachined portion of pipe shall be tested in accordance with the appropriate section of test methods **C497**, except that when the perforated underdrain pipe is tested, the sample shall contain four circumferential rows of holes with the first row 1.5 in. [40 mm] from the end. The specimen shall be tested with the line of symmetry of the rows facing downward, with the rows of holes being in the lower two quadrants.

7. Couplings

7.1 Each standard, short, or random length of pipe shall be provided with a coupling for the purpose of maintaining alignment and to ensure close joints.

8. Fittings

8.1 Fiber-cement underdrain pipe fittings shall be suitable in size, type, crushing strength, and design for the pipe with which they will be furnished.

TABLE 1 Crushing Strength

Nominal Size		Crushing Load, min	
in.	[mm]	lbf/ft	kN/m
4	100	1000	15
6	150	1100	16
8	200	1300	19
10	250	1400	20
12	300	1500	22

9. Sizes and Dimensions

9.1 The nominal length for fiber-cement underdrain pipe shall be designated by the manufacturer. Unless otherwise agreed by the Owner, furnish a maximum of 15 % of the total footage of any one size and type for any order, at the manufacturer’s option, in pipe lengths shorter than the nominal. These shall be termed random lengths.

9.2 A tolerance of 1 in. [25 mm] shall apply to nominal standard lengths, and 6 in. [150 mm] shall apply to random lengths. For billing purposes, random lengths shall be classified to 6 in. [150 mm] increments, allowing a tolerance of +5 and –1 in. [+125 and – 25 mm].

9.3 The average inside diameter of the pipe shall not be less than nominal by 0.25 in. [6 mm] or 1½ %, whichever is greater.

10. Perforations

10.1 Perforations, when required, shall be circular holes, 0.25 ± 0.05 in. [6 ± 1.5 mm] in diameter, arranged in rows parallel to the axis of the pipe. Perforations shall be approximately 3 in. [75 mm] center-to-center, along the rows. Rows shall be arranged in two equal groups on either side of the vertical center line of the pipe, and the total number of rows shall be as shown in **Table 2**. The lowermost rows of perforations in each group shall be separated by an arc of 90° [1.6 rad] and the upper most rows of perforations in each group shall be separated by an arc of 160° [2.8 rad]. The spacing of rows between these limits shall be uniform. Holes may appear at the ends of short and random lengths.

11. Sampling

11.1 All material tested under this specification shall be in a saturated condition after immersion under water at $73 \pm 7^\circ\text{F}$ [$23 \pm 4^\circ\text{C}$] for a minimum of 24 h.

11.1.1 Employ sampling procedures providing an average outgoing quality limit (AOQL) of 6.5 %, except where specific sampling is required by particular test procedures. Appendix X2 describes a sampling plan which provides an AOQL of 6.5 %.

11.1.2 The minimum sample size for sampling and acceptance by attributes or variables shall be in **Table 3**.

11.1.3 Pipes of different sizes or classes but of sequential manufacture in a continuous manufacturing process may be sampled as being in the same inspection lot.

11.2 For crushing tests sample the required number of full lengths of pipe according to the inspection lot size. Cut one test specimen 12 in. [300 mm] long from the unmachined end of each of the selected pipe lengths. (**Warning**—In addition to

TABLE 2 Perforations

Nominal Size		Rows of Perforations
in.	[mm]	
4	100	4
6	150	4
8	200	4
10	250	6
12	300	6