



Standard Specification for Non-Asbestos Fiber-Cement Conduit¹

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1. Scope

1.1 This specification covers non-asbestos fiber-cement conduit for use in electric-power systems and communication systems. The service is for both underground and exposed conditions.

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

2. Referenced Documents

2.1 ASTM Standards:²

C150 Specification for Portland Cement

C497 Test Methods for Concrete Pipe, Manhole Sections, or Tile

C500 Test Methods for Asbestos-Cement Pipe

C595 Specification for Blended Hydraulic Cements

C1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products

2.2 Military Standard:

MIL-STD-129 Marking for Shipment and Storage³

2.3 Federal Standard:

No. 123 Marking for Domestic Shipment (Civilian Agencies)³

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 Non-Asbestos 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 Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.4 ISO Standards:

ISO 390 Products in Fibre Reinforced Cement—Sampling and Inspection⁴

ISO 2859–1 Sampling Procedures for Inspection by Attributes Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-Lot Inspection⁴

ISO 3951 Sampling Procedures and Charts for Inspection by Variables for Percent Nonconforming⁴

2.5 Other Standards:

Uniform Freight Classification Rules⁵

National Motor Freight Classification Rules⁶

3. Terminology

3.1 *Definitions*—Refer to Terminology C1154.

3.1.1 *conduit, n*—fiber-cement pipe used to protect wires for electric-power or communication systems, for both underground and exposed situations.

3.1.2 *coupling*—component made from a larger diameter pipe of the same type or Type II and of the same class or 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.

3.1.3 *fittings*—fittings such as adapters, reducers, increasers, bends, and bell ends, for use in laying fiber-cement conduit as described in Section 5 and made to such dimensions as will provide equivalent strength and silt-tight joints when assembled with the conduit.

4. Classification

4.1 The classes of conduit shall be as follows:

4.1.1 *Class B*—Intended for use encased in concrete after installation, and

4.1.2 *Class C*—Intended for use without concrete encasement, or for exposed services.

⁴ Available from International Organization for Standardization (ISO), 1 rue de Varembe, Case postale 56, CH-1211, Geneva 20, Switzerland.

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.

4.2 The types of conduit shall be known as Type I and Type II corresponding to the chemical requirements given in Section S3 of this specification. For a more thorough understanding and as a guide to the chemical resistance of fiber-cement conduit, reference is made to Test Methods C500.

NOTE 1—There are no chemical requirements for Type I Conduit.

NOTE 2—To assist the purchaser in choosing the type of conduit most suitable for his use, the following descriptions of usage may be considered:

4.2.1 *Type I*—For use where nonaggressive water and soil of moderate sulfate content are expected to come in contact with the conduit, and

4.2.2 *Type II*—For use where moderately aggressive water or water and soil of high sulfate content, or both, are expected to come in contact with the conduit.

4.3 The conduit shall be furnished in 1.5, 2, 3, 4, 5, and 6-in. [40, 50, 75, 100, and 150 mm] nominal sizes and shall have a circular cross section.

5. Materials and Manufacture

5.1 Fiber-cement conduit shall be composed of an intimate mixture of an inorganic hydraulic binder (see Specification C150) or a calcium silicate binder (see Specification C595) 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. All 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. Mechanical Properties

6.1 Flexural Strength:

6.1.1 Each 10 or 13 ft [3048 or 3962 mm] standard length and each 9.5 ft [2896 mm] or longer random length conduit shall have sufficient flexural strength to withstand, without failure, the total load prescribed in Table 1, when tested in accordance with 6.1.1.1.

6.1.1.1 The specimen shall be mounted longitudinally on “V” blocks, preferably of hard wood or of steel, 2 in. [50 mm] long, 120° [2 rad] angle of “V,” faces 5 by 2 in. [130 by 50 mm], and the load applied through a rectangular block, 2 in. [50 mm] in width, at the center of the span. The spans between the faces of supporting blocks shall be as given in Table 1 for the particular class of conduit. The breaking loads, the average

of at least two specimens from each length, shall not be less than those given in Table 1 for the particular class of conduit.

6.2 *Crushing Strength*—Crushing tests shall be conducted before shipment. 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.

7. Dimensions, Mass, and Tolerances

7.1 The average inside diameter measured at the end of the conduit shall be ± 0.1 in. [± 3 mm] of the nominal inside diameter.

7.2 The bore of the conduit shall pass freely through a mandrel 3 ft [1 m] long and 0.25 in. [6 mm] less in diameter than the nominal inside diameter of the conduit.

7.3 The inner dimensions of the bends shall be such that a ball 0.4 in. [10 mm] less in diameter than the nominal inside diameter of the conduit, shall pass freely through them.

7.4 Couplings and coupling areas of the conduit shall be machined or otherwise finished to such dimensions as will provide silt-tight joints when assembled with proper accessories and put into the service for which the conduit is intended.

7.5 The nominal length for fiber-cement conduit 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.

8. Workmanship, Finish, and Appearance

8.1 Machined ends of the conduit that receive the coupling shall be free of dents and gouges that will affect the silt-tightness of the joint.

8.2 Each conduit shall be free of bulges, dents, and tears on the inside surface that result in a variation of more than 0.2 in. [5 mm] from the adjacent unaffected portions of the surface.

8.3 All inside edges of the conduit shall be rounded and smooth. The ends of each length of conduit shall be at right angles to the axis of the conduit.

9. Sampling

9.1 Test all material under this specification after immersion under water at $73 \pm 7^\circ\text{F}$ [$23 \pm 4^\circ\text{C}$] 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.

9.1.1 Employ sampling procedures providing an average outgoing quality limit (AOQL) of 6.5 %, except where specific sampling is required by particular test procedures. Appendix X1 describes a sampling plan which provides an AOQL of 6.5 %.

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

9.1.3 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.

9.2 For crushing tests sample the required number of full lengths of pipe according to the inspection lot size. Cut one test

TABLE 1 Flexural Strength Requirements

Nominal Inner Diameter		Test Span (Free Span)		Class B Applied Test Load		Class C Applied Test Load	
in.	[mm]	in.	[mm]	lbf	[kN]	lbf	[kN]
1.5	40	30	760	600	2.70	850	3.80
2	50	30	760	600	2.70	850	3.80
3	75	30	762	600	2.70	850	3.80
4	100	30	762	980	4.40	1260	5.60
5	130	48	1219	1100	4.90	1500	6.70
6	150	54	1372	1300	5.80	2000	8.90