



Designation: C 296 - 76

PLAINTIFF'S EXHIBIT

CT-1257

AMERICAN SOCIETY FOR TESTING AND MATERIALS

1916 Race St., Philadelphia, Pa. 19103

Reprinted from the Annual Book of ASTM Standards, Copyright ASTM
If not listed in the current combined index, will appear in the next edition.

Standard Specification for ASBESTOS-CEMENT PRESSURE PIPE¹

This Standard is issued under the fixed designation C 296; 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.

This specification has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This specification covers asbestos-cement pressure pipe for use in supply lines and distribution systems that carry water under pressure. The specification also covers asbestos-cement pressure pipe for use in sewer force mains which carry sewage under pressure.

2. Applicable Documents

2.1 ASTM Standards:

C 500 Testing Asbestos-Cement Pipe²

D 1869 Specification for Rubber Rings for Asbestos-Cement Pipe.²

3. Classification

3.1 Asbestos-cement pipe furnished under this specification shall be manufactured in the pressure class designations of Classes 100, 150, and 200. The pressure class designations shall mean that the pipe is intended for water service at operating pressures corresponding to the class designation under the conditions of installation and operation encountered in many water distribution systems.

NOTE 1—The purchaser should determine for himself the proper class of pipe to be used under the installation and operating conditions that will exist on the project on which the pipe is to be used. For this purpose, reference can be made to AWWA H2, Standard Practice for the Selection of Asbestos-Cement Water Pipe.

3.2 The types of pipe shall be known as Type I and Type II corresponding to the chemical requirements in Section 10 of this specification.

NOTE 2—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 asbestos-cement pipe are covered in Section 19 to 25 of Methods C 500.

4. Definitions

4.1 *pipe*—asbestos-cement pressure pipe as defined in Sections 1, 3, and 5.

4.2 *coupling*—a section for joining asbestos-cement pipe that, when properly installed with the proper accessories, develops a joint equivalent in strength and serviceability to the pipe sections.

4.3 *purchaser*—the actual purchaser of the pipe or his authorized agents acting within the scope of the duties entrusted to them.

4.4 *lot*—a lot as used herein for pipe 21 in. in diameter and smaller is defined as each 300 lengths of pipe or less, of identical class and size manufactured on each machine during a 24-h period. A lot as used herein for pipe larger than 21 in. in diameter is defined as each 300 lengths of pipe or less, of identical class and size manufactured on each machine during a period of consecutive working days not exceeding 7 days.

5. Manufacture

5.1 Asbestos-cement pressure pipe shall be

¹ This specification is under the jurisdiction of ASTM Committee C-17 on Asbestos-Cement Products.

Current edition approved May 28, 1976. Published July 1976. Originally published as C 296 - 52. Last previous edition C 296 - 73b.

² Annual Book of ASTM Standards, Part 16.

composed of an intimate mixture of portland cement or portland blast-furnace slag cement and asbestos fiber with or without silica; or it shall be composed of portland-pozzolan cement and asbestos fiber. The mixture shall be free of organic additives. 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. Rubber Rings

6.1 The rubber rings used to seal the joints of the asbestos-cement pipe shall conform to the requirements of the latest revision of Specification D 1869.

7. Hydrostatic Strength

7.1 Each standard, random or short length of pipe (Section 12) and each coupling sleeve, when manufactured from the same material as the pipe, shall be hydrostatically tested by the manufacturer prior to shipment and shall have sufficient strength to withstand the internal hydrostatic pressure prescribed in Table 1, when tested in accordance with Section 5 of Methods C 500.

7.2 From each lot which has passed the routine hydrostatic proof test, one length shall be selected by the inspector. Each selected length shall be hydrostatically tested in accordance with Section 5 of Method C 500 to a pressure of four times the rated working pressure for the class of pipe, maintaining such pressure for not less than 5 s. The pipe shall not fail under this pressure. Each pipe so tested shall be retested in accordance with 7.1 of this specification.

8. Flexural Strength

8.1 Each length of pipe in sizes 4, 6, and 8 in. (102, 152, and 203 mm) shall have sufficient flexural strength to withstand, without failure, the total load prescribed in Table 2, when tested in accordance with Section 8 of Methods C 500.

9. Crushing Strength

9.1 When specifically requested by the purchaser in his order, crushing tests shall be conducted before shipment at the purchaser's expense. A one-foot length of pipe for each lot

cut from an unmachined portion of the pipe shall have sufficient strength to resist the minimum crushing load prescribed in Table 3, when tested in accordance with Section 11.1.1 of Methods C 500.

10. Chemical Requirements

10.1 When uncombined calcium hydroxide tests are requested, one sample shall be taken from each lot of pipe and tested in accordance with Sections 14 through 18 of Methods C 500. Sample to be tested may be taken from one of the specimens selected for the crushing test. The amount of uncombined calcium hydroxide shall not exceed 1.0 % for Type II pipe.

NOTE 3—There are no chemical requirements for Type I pipe.

11. Sampling

11.1 All pipe and couplings tested under this specification shall be in a normal air-dried condition.

12. Sizes and Dimensions

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

12.2 Pipe shall be manufactured with nominal inside diameters of 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, and 36 in. (102, 152, 203, 254, 304, 356, 406, 457, 508, 610, 762, and 914 mm) in Classes 100, 150, and 200 as defined in Section 3. The average diameters of standard and random lengths may be less than the nominal by not more than 5.0 percent, when measured approximately 3 in. (76.2 mm) from the end.

12.3 The standard length shall be 13 ft $\pm$ 1 in. (3960 $\pm$ 25 mm). Alternative lengths shall be 10 ft $\pm$ 1 in. (3050 $\pm$ 25 mm) for 4 and 6-in. (102 and 203-mm) pipe and 16 ft $\pm$ 1 in. (4880 $\pm$ 25 mm) for 14-in. (356-mm) and larger pipe. At least 85 percent of the total footage of pipe of any one class, type, and size, excluding short lengths, shall be furnished in standard lengths. The remaining 15 percent may be in random lengths of not less than 7 ft. (2.13 m). Short lengths, when specifically ordered, shall not exceed 6 ft. 9 in. (2.06 m).



13. Workmanship and Finish

13.1 Machined ends of the pipe that receive the coupling shall be free of dents and gouges that will affect the tightness of the joint.

13.2 Each pipe shall be free of bulges, dents, and tears in the inside surface that result in a variation in diameter of more than $\frac{1}{16}$ in. (4.8 mm) from that obtained on adjacent unaffected portions of the surface.

13.3 Each length of pipe shall not vary in straightness by more than 0.05 in./ft (0.004 mm/m) of length when the variation is measured in accordance with Section 13 of Methods C 500.

14. Marking and Shipping

14.1 Each standard and random length of pipe shall be marked by the manufacturer with the trade name, nominal size, class, hydrostatic proof pressure, and date of manufacture. Each coupling sleeve, if made of the same material as the pipe, shall be marked by the manufacturer with the nominal size, class, and the letter "T" to indicate that it has been hydrostatically tested.

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

15. Inspection and Rejection

15.1 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 in 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 such inspection, when requested, the manufacturer

shall be prepared to certify that his product conforms to the requirements of this specification.

15.2 Each pipe and coupling shall be inspected by the manufacturer, before shipment, for compliance with the standards for dimensions, tolerances, and workmanship and finish (see also Section 11).

15.3 Failure of any specimen tested for crushing strength to withstand 75 percent of the load specified in Section 8 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 percent but under 100 percent of the load specified in Section 9, one specimen shall be cut from each of two additional pipes of the same lot. Failure of either of these additional specimens to meet the strength requirements of Section 9 shall be cause for rejection of the entire lot from which the original sample was taken.

15.4 If any pipe subjected to the hydrostatic test described in Section 5 of Methods C 500 fails to withstand the higher pressure specified in 7.2, two additional lengths of the same size and class shall be selected from the pipe manufactured during the same shift and shall be subjected to the higher hydrostatic test. The failure of one of these additional lengths to withstand the specified pressure shall be cause for rejection of the entire lot of that size and class manufactured during the same shift as the test lengths.

15.5 If the results of the uncombined calcium hydroxide test show that 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 Section 8 shall be cause for rejection of the lot.

TABLE 1 Applied Hydrostatic Proof Pressures

Class	Applied Pressure, psi (MPa)
100	350 (2.4)
150	525 (3.6)
200	700 (4.8)

TABLE 2 Applied Flexural Proof Loads

Nominal size, in. (mm)	Total Applied Load, lbf (kN)		
	Class 100	Class 150	Class 200
4 (101.6)	1200 (5.3)	1470 (6.6)	1 870 (8.4)
6 (152.4)	2800 (12.5)	3700 (16.5)	4 900 (21.8)
8 (203.2)	5330 (25.9)	7600 (33.8)	10 130 (45.1)

TABLE 3 Minimum Crushing Loads

Nominal Size, in. (mm)	Crushing Strength per Lineal Foot, lbf (kN/m)		
	Class 100	Class 150	Class 200
4 (102)	4 100 (59.8)	5 400 (78.8)	8 700 (126.9)
6 (152)	4 000 (58.4)	5 400 (78.8)	9 000 (131.3)
8 (203)	4 000 (58.4)	5 500 (80.2)	9 300 (135.8)
10 (254)	4 400 (64.2)	7 000 (102.1)	11 000 (160.5)
12 (304)	5 200 (75.8)	7 600 (110.8)	11 800 (172.3)
14 (356)	5 200 (75.8)	8 600 (125.5)	13 500 (197.1)
16 (406)	5 800 (84.6)	9 200 (134.2)	15 400 (224.8)
18 (457)	6 500 (94.8)	10 100 (147.4)	17 400 (254.0)
20 (508)	7 100 (103.6)	10 900 (159.0)	19 400 (283.2)
24 (610)	8 100 (118.2)	12 700 (185.3)	22 600 (329.9)
30 (762)	9 700 (141.5)	15 900 (231.9)	28 400 (414.6)
36 (914)	11 200 (163.4)	19 600 (285.9)	33 800 (493.5)

APPENDIX

A1. ADDITIONAL INFORMATION

A1.1 It is suggested to the purchaser, without being made a part of this specification, that the purchaser may request inclusion of the following information in his order or agreement for purchase of the pipe:

A1.1.1 Any tests, in addition to those prescribed by this specification, as the special circumstances may require.

A1.1.2 The place or places where any additional tests are to be made.

A1.1.3 Description of the additional testing facilities.

A1.1.4 Who shall bear the expense of such additional tests.

A1.1.5 Whether such additional tests may be made by any sound sampling process or other method approved by the parties, and

A1.1.6 Such other matters as the parties may find desirable to include in their written agreement.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.