



Designation: C 668 – 98 (Reapproved 2003)^{ε1}

Standard Specification for Asbestos-Cement Transmission Pipe¹

This standard is issued under the fixed designation C 668; 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.

This standard has been approved for use by agencies of the Department of Defense.

^{ε1} NOTE—Warning notes were editorially moved into the standard text in July 2003.

1. Scope

1.1 This specification covers asbestos-cement transmission pipe intended for use in transmission systems that carry fluids under pressure. A transmission system consists of pipe lines which convey fluids from their source to a point of distribution or discharge. The system is characterized by relatively steady flow and few appurtenances, thereby permitting reasonable hydraulic analysis, including surge analysis.

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

NOTE 1—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. See Note 4 10.1 for a specific hazards statement.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 150 Specification for Portland Cement²

¹ This specification is under the jurisdiction of ASTM Committee C-17 on Fiber-Cement Products and is the direct responsibility of C17.03 on Asbestos-Cement Products. Current edition approved Sept. 10, 1998; 2003. Published March 1999; July 2003. Originally published as C 668—70; approved in 1970. Last previous edition C 668—91(1995)^{ε1}; approved in 1998 as C 668—98.

C 458 Test Method for Organic Fiber Content of Asbestos-Cement Products³

C 500 Test Methods for Asbestos-Cement Pipe³

C 595 Specification for Blended Hydraulic Cements²

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in ~~Portland~~ Cement Concrete⁴

D 1869 Specification for Rubber Rings for Asbestos-Cement Pipe⁵

D 2946 Terminology for Asbestos and Asbestos-Cement Products³

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁶

2.3 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage⁶

2.4 *Other Standards:*

Uniform Freight Classification Rules⁷

National Motor Freight Classification Rules⁸

3. Terminology

3.1 *Definitions:*

3.1.1 *coupling*—fitting made from larger diameter pipe of the same type and class, or of Type II and a higher class 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.

3.1.2 *lot, n*—for pipe sizes 525 mm (21 in.) in diameter and smaller, each 300 lengths of pipe or less, of identical class and size manufactured on each machine during a 24-h period. For pipe larger than 525 mm (21 in.), 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 seven days.

3.1.3 Additional terminology is given in Terminology D 2946.

4. Classification

4.1 Asbestos-cement pipe furnished under this specification shall be manufactured in Classifications 21, 24, 28, 31, 34, 41, 58, 55, and 62. Note that these numbers correspond to ten times the minimum hydrostatic strength, in MPa (30, 35, 40, 45, 50, 60, 70, 80, and 90). This classification corresponds to one tenth of the minimum hydrostatic strength, in psi).

4.2 The types of pipe shall be known as Type I and Type II corresponding to the chemical requirements in 7.1.

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 Sections 19 to 25 of Test Methods C 500.

5. Manufacture

5.1 Asbestos-cement furnished under this specification shall be composed of an intimate mixture of portland cement, conforming to Specification C 150, or portland slag or pozzolan cements conforming to Specification C 595, and asbestos fiber with or without finely divided silica or silica-containing mineral additives conforming to Specification C 618 that can react to form calcium silicate reaction products, and asbestos fiber. The mixture shall not contain more than 0.2 % of non-deleterious organic

² Annual Book of ASTM Standards, Vol 04.01.

³ Annual Book of ASTM Standards, Vol 04.05.

⁴ Annual Book of ASTM Standards, Vol 04.02.

⁵ Annual Book of ASTM Standards, Vol 09.02.

⁶ Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094 Attn: NPODS.

⁷ Available from the Uniform Classification Commission, Room 1106, 222 S. Riverside Plaza, Chicago, IL 60606.

⁸ Available from National Motor Freight Inc., 1616 "P" St., NW, Washington, DC 20036.

TABLE 1 Applied Hydrostatic Proof Pressures^A

Pipe Classification		Applied Hydrostatic Pressure	
10 × MPa rating	(¹ / ₁₀ psi rating)	MPa	(psi)
21	(30)	1.55	(225)
24	(35)	1.81	(262)
28	(40)	2.07	(300)
31	(45)	2.32	(337)
34	(50)	2.58	(375)
41	(60)	3.10	(450)
48	(70)	3.62	(525)
55	(80)	4.13	(600)
62	(90)	4.65	(675)

^A The pressures and classifications indicated apply to all sizes.

TABLE 2 Minimum Hydrostatic Strength^A

Pipe Classification		Hydrostatic Pressure Rating	
10 × MPa rating	($\frac{1}{10}$ psi rating)	MPa	(psi)
21	(30)	2.1	(300)
24	(35)	2.4	(350)
28	(40)	2.8	(400)
31	(45)	3.1	(450)
34	(50)	3.4	(500)
41	(60)	4.1	(600)
48	(70)	4.8	(700)
55	(80)	5.5	(800)
62	(90)	6.2	(900)

^A The pressures and classifications indicated apply to all sizes.

components, as determined by Test Method C 458. 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 Specification D 1869.

7. Chemical Requirements

7.1 When uncombined calcium hydroxide tests are requested, one sample shall be taken from each lot of pipe and tested in accordance with Test Methods C 500. The 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 % for Type II pipe.

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

8. Hydrostatic Strength

8.1 Each standard, random, or short length of pipe (see Section 11) and each coupling sleeve, 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 Test Methods C 500.

8.2 From each lot of pipe which has passed the routine hydrostatic proof test, one length shall be selected by the inspector. A 30 cm (12 in.) or longer section of pipe cut from an unmachined portion of the selected length shall have the minimum hydrostatic strength designated in Table 2, when tested in accordance with Test Methods C 500, except that the pressure need not be held for 5 s.

9. Flexural Strength

9.1 Each length of pipe in sizes 15 and 20 cm (6 and 8 in.) nominal diameter having lengths 30 cm (12 in.) or longer shall have sufficient flexural strength to withstand without failure the total load prescribed in Table 3 when tested in accordance with Test Methods C 500.

10. Crushing Strength

10.1 From each lot, one length shall be selected by the inspector. A 30 cm (1 ft) section of pipe cut from an unmachined portion of the selected length shall have the minimum crushing strength prescribed in Table 4 and Table 5 when tested in accordance with Test Methods C 500, Vee Shaped Three Edge Bearing Method.

NOTE 4—**Precaution: Method. (Warning—** In addition to other precautions, when cutting asbestos-cement products minimize the dust that results. Prolonged or frequent breathing of significant airborne concentrations of silica or asbestos dust is hazardous. When such dusts are

TABLE 3 Minimum Applied Flexural Proof Loads

Pipe Classification		Nominal Size			
10 × MPa rating	($\frac{1}{10}$ psi rating)	15 cm (6 in.)		20 cm (8 in.)	
		kN	(lbf)	kN	(lbf)
21	(30)	—	—	16	(3700)
24	(35)	—	—	20	(4400)
28	(40)	10	(2300)	23	(5100)
31	(45)	11	(2500)	25	(5700)
34	(50)	12	(2800)	28	(6400)
41	(60)	14	(3200)	31	(6900)
48	(70)	16	(3700)	34	(7600)
55	(80)	18	(4000)	39	(8800)
62	(90)	22	(4900)	45	(10100)

TABLE 4 Minimum Crushing Strength, kN/linear, m

Nominal Size		Pipe Classification									
cm	(in.)	10 × MPa rating (0.1 psi rating)	21 (30)	24 (35)	28 (40)	31 (45)	34 (50)	41 (60)	48 (70)	55 (80)	62 (90)
15	6	—	—	—	35	47	58	69	79	98	131
20	8	29	35	41	50	58	70	80	108	136	161
25	10	29	37	44	51	66	80	102	131	161	161
30	12	29	37	44	58	76	93	114	146	178	178
35	14	29	37	44	58	76	102	128	161	197	197
38	15	34	41	48	63	80	108	136	175	212	212
41	16	37	44	51	66	85	110	139	181	225	225
46	18	37	44	58	73	95	124	161	204	263	263
51	20	37	51	66	80	104	139	175	219	292	292
53	21	37	51	66	85	107	142	182	234	307	307
61	24	41	56	73	90	118	161	219	277	350	350
69	27	51	61	80	102	128	182	241	299	394	394
76	30	51	66	88	110	142	197	263	328	438	438
84	33	51	73	95	117	153	212	285	358	482	482
91	36	58	73	102	131	163	234	307	379	525	525
99	39	61	77	110	142	175	251	328	409	569	569
107	42	63	83	117	153	190	270	350	438	613	613

TABLE 5 Minimum Crushing Strength, 100 lbf/linear ft

Nominal Size		Pipe Classification									
cm	(in.)	10 × MPa rating (0.1 psi rating)	21 (30)	24 (35)	28 (40)	31 (45)	34 (50)	41 (60)	48 (70)	55 (80)	62 (90)
15	6	—	—	24	32	40	47	54	67	90	90
20	8	20	24	28	34	40	48	55	74	93	93
25	10	20	25	30	35	45	55	70	90	110	110
30	12	20	25	30	40	52	64	78	100	122	122
35	14	20	25	30	40	52	70	88	110	135	135
38	15	23	28	33	43	55	74	93	120	145	145
41	16	25	30	35	45	58	75	95	124	154	154
46	18	25	30	40	50	65	85	110	140	180	180
51	20	25	35	45	55	71	95	120	150	200	200
53	21	25	35	45	58	73	97	125	160	210	210
61	24	28	38	50	62	81	110	150	190	240	240
69	27	35	42	55	70	88	125	165	205	270	270
76	30	35	45	60	75	97	135	180	225	300	300
84	33	35	50	65	80	105	145	195	245	330	330
91	36	40	50	70	90	112	160	210	260	360	360
99	39	42	53	75	97	120	172	225	280	390	390
107	42	43	57	80	105	130	185	240	300	420	420

generated, effective measures shall be taken to prevent inhalation. Refer to approved techniques.⁹⁾

11. Dimensions, Mass, and Permissible Variations

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

11.2 Pipe shall be manufactured with nominal inside diameters of 15, 20, 25, 30, 35, 38, 41, 46, 51, 53, 61, 69, 76, 84, 91, 99, and 107 cm (6, 8, 10, 12, 14, 15, 16, 18, 20, 21, 24, 27, 30, 33, 36, 39, and 42 in.) in the classifications defined in 4.1 except 15 cm (6 in.) diameter pipe shall be of Classification 40 through 90 only. The average diameters of standard and random lengths may be less than the nominal inside diameter by not more than 5 %, when measured approximately 75 mm (3 in.) from the end.

11.3 The standard length shall be 4 m ± 25 mm (13 ft ± 1 in.). Alternative standard lengths shall be 3 m ± 25 mm (10 ft ± 1 in.) for 15-cm (6-in.) pipe and 5 m ± 25 mm (16 ft ± 1 in.) for 36-cm (14-in.) and larger pipe. At least 85 % of the total footage of pipe of any one classification, type, and size, excluding short lengths, shall be furnished in standard lengths. The remaining 15 % may be in random lengths of not less than 2 m (7 ft). Short lengths, when specifically ordered, shall not exceed 2 m (6.75 ft).

12. Workmanship and Finish

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

⁹⁾ Available from Asbestos Information Association, 1745 Jefferson Davis Highway, Crystal Square 4, Suite 509, Arlington, VA 22202.

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

13. Sampling

13.1 All samples shall be in a normal air-dried condition in equilibrium with the atmospheric moisture when tests are initiated.

14. Inspection and Rejection

14.1 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 (see Appendix X1), 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.

14.2 Pipe and couplings shall be inspected by the manufacturer, before shipment, for compliance with the standards for dimensions, and workmanship, and finish (see also Sections 7-10).

14.3 Failure of any specimen tested for crushing strength to withstand 75 % of the load specified in Section 10 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 Section 10, 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 10 shall be cause for rejection of the entire lot from which the original sample was taken.

14.4 If any pipe subjected to the hydrostatic strength test described in 8.2 fails to withstand the pressure specified, two additional lengths of the same size and classification shall be selected from the pipe manufactured during the same shift and shall be subjected to the specified pressure. 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 classification manufactured during the same shift as the test lengths.

14.5 If the results of the uncombined calcium hydroxide test shows 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 7 shall be cause for rejection of the lot.

15. Marking and Shipping

15.1 Each standard and random length of pipe shall be marked by the manufacturer with the trade name, nominal size, classification, and date of manufacture, in alkali resistant ink or indelible paint. The trade name shall include, but is not limited to, the manufacturer's name or trademark and the words "Transmission Pipe." Each coupling sleeve, if made of the same material as the pipe, shall be marked by the manufacturer with the nominal size, classification, and the letter "T" to indicate that it has been hydrostatically tested.

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

16. Keywords

16.1 asbestos; asbestos-cement; asbestos-cement pipe; transmission; transmission pipe

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 that 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 may use his own or any other 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 assure that material conforms to prescribed requirements.

APPENDIX

(Nonmandatory Information)

X1. ADDITIONAL PURCHASE ORDER OPTIONS

X1.1 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:

X1.1.1 Any test, in addition to those prescribed by this specification, as the special circumstances may 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 may be made by any sound sampling process or other method approved by the parties,
and

X1.1.6 Such other matters as the parties may find desirable to include in their written agreement.

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