

American Water Works Association

ANSI/AWWA C402-89

(Revision of ANSI/AWWA C402-84)



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STANDARDS DEPARTMENT

AWWA STANDARD
FOR
ASBESTOS-CEMENT TRANSMISSION PIPE,
18 IN. THROUGH 42 IN.
(450 mm THROUGH 1050 mm),
FOR POTABLE WATER AND OTHER LIQUIDS



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AMERICAN WATER WORKS ASSOCIATION

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AWWA Standard

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Foreword

This foreword is for information only and is not part of C402.

I. History of Standard. A new pipe material consisting of an intimate mixture of portland cement and asbestos fibers was introduced to the North American market in 1931 following several years of use in other countries, particularly Italy.

In the ensuing years, this type of pipe gained popularity, and in 1949 AWWA established a committee on standard specifications for asbestos-cement pipe under the chairmanship of S.M. Clarke of Greeley and Hansen, Chicago, Ill.

The committee developed a standard for asbestos-cement water pipe, which was approved by the AWWA Board of Directors as a tentative standard, AWWA C400-53T, on May 15, 1953. In 1958, the committee was reactivated as Committee 8340D on Asbestos-Cement Pipe under the chairmanship of Roy H. Ritter of Whitman, Requardt, and Associates, Baltimore, Md., to review several suggested changes and to recommend revisions to the standard. The committee produced a tentative standard adopted by AWWA as C400-64T on Jan. 27, 1964. It was advanced to standard without revision on July 2, 1965.

In early 1968, the committee was reactivated as the Standards Committee on Asbestos-Cement Pipe to review and revise all of the AWWA standards on asbestos-cement pipe. The committee produced a revised standard approved by the Board of Directors on Jan. 31, 1972, and designated as AWWA C400-74, Standard for Asbestos-Cement Pressure Pipe for Water and Other Liquids.

In the winter of 1972-73, the committee was reorganized and enlarged to include representation of national organizations having an interest in the scope of the committee and wishing to participate in the work. The reorganized committee reaffirmed C400-72 without revision and it was presented to the American National Standards Institute and designated as an American National Standard.

In 1975, the committee produced a revised standard approved by the AWWA Board of Directors on Jan. 26, 1975, and designated as AWWA C400-75, Standard for Asbestos-Cement Pressure Pipe, 4 In. Through 24 In., for Water and Other Liquids.

Also on Jan. 26, 1975, the AWWA Board of Directors approved the first edition of this standard designated as AWWA C402-75, Standard for Asbestos-Cement Transmission Pipe, 18 In. Through 42 In., for Water and Other Liquids. This first edition adopted a new system of manufactured pipe-strength classifications, which provided designers with the flexibility to choose among nine standard pipe-strength classifications for each size of transmission pipe. This design capability is of particular significance for large-diameter pipeline projects where tailoring of pipe strength to project conditions can produce significant savings in material costs. Such savings can exceed the increased costs necessitated by more detailed design, better control over installation methods, and provisions for surge controls when justified.

The standard was revised in 1977 to provide a more detailed description of aggressive soil and water conditions, redefinition of manufactured lots, and definition of the machines to be used for physical testing. AWWA C402-77 was approved by the AWWA Board of Directors on Jan. 30, 1977.

The 1977 edition of the standard was again revised in 1984 to incorporate soft metric equivalents, provide explanations of methods for testing for hydrostatic and crushing requirements, and included appendix A, which described fittings for use

with asbestos-cement transmission pipe. AWWA C402-84 was approved by the AWWA Board of Directors on Jan. 30, 1984.

In 1978, the American Water Works Association issued AWWA Manual M16, *Work Practices for Asbestos-Cement Pipe*,* under the chairmanship of Jephtha A. Wade. This manual was strongly endorsed by the standards committee on asbestos-cement pipe, and should be carefully followed in all aspects of asbestos-cement pipe installation.

II. Information Regarding Use of This Standard.

II.A General. When ordering pipe covered by this standard, local installation and operating conditions should be considered to determine the classification and type of pipe to specify. Also, certain other items must be specified to describe completely the pipe required.

It is recommended that, for large-diameter pipeline projects, the purchaser evaluates local installation and operating conditions, operating pressures and surge pressures, trench loads, and surface loads when determining the strength classification to be used.

The purchaser is referred to AWWA C403, Standard Practice for the Selection of Asbestos-Cement Transmission and Feeder Main Pipe, Sizes 18 In. Through 42 In.,† for guidance in the design of asbestos-cement pipe to fit individual installation and operating conditions, and to AWWA C603, Installation of Asbestos-Cement Pressure Pipe, for guidance in the installation of the pipe.

Effective July 21, 1986, the Occupational Safety and Health Administration (OSHA) revised its standards for workplace exposure to airborne asbestos particles. The current standard makes the employer responsible for ensuring that employee exposures to airborne asbestos fiber concentrations do not exceed stringent exposure limits. The OSHA construction standard on asbestos, 29 CFR 1926, prescribes initial air monitoring and other compliance measures. The OSHA requirements apply to the manufacture, shipping, handling, installation, and repair of asbestos-cement pipe and appurtenances. It is recommended that users and prospective users of asbestos-cement pipe familiarize themselves with the current OSHA asbestos work practice standards.

II.B Flexural load test. Flexural load tests are not required (Sec. 2.2.1 and Sec. 5.2.3). For large diameters, the wall thicknesses increase to a point at which the flexural strength is not a controlling factor, and therefore, routine testing is not required.

II.C Type of pipe. The following criteria are presented for determining the type of pipe to be used under various soil and water conditions. Each condition should be considered separately even though each may exist in combination with others.

These criteria are based on exposures within the temperature range of 40–80°F (5–28°C). For pipe exposures to temperatures beyond these limits, consult the manufacturer for guidance in the installation of the pipe.

**Work Practices for Asbestos-Cement Pipe*, AWWA Manual M16, AWWA, Denver, Colo. (1978).

†Current (1988) production in the United States is limited to a maximum size of 24 in. (610 mm).

The following criteria are referenced as:

1. Internal water (Table F.1).
2. External water (Table F.2).
3. Nonacid soluble sulfates—internal and external (Table F.3).
4. Acid soluble sulfates—internal and external.

II.C.1 Internal water. Aggressiveness of water transported through asbestos-cement pipes is related to the type designation of asbestos-cement pipe suitable for such use in Table F.1. Aggressiveness of water is defined as follows:

- (a) Highly aggressive: $\text{pH} + \log (AH) < 10.0$
- (b) Moderately aggressive: $\text{pH} + \log (AH) = 10.0$ through 11.9
- (c) Nonaggressive: $\text{pH} + \log (AH) \geq 12.0$

Where:

pH = index of acidity (or alkalinity) of the water—standard pH units
 A = total alkalinity—mg/L as CaCO_3
 H = calcium hardness—mg/L as CaCO_3

It should be recognized that water with a $\text{pH} + \log (AH)$ less than or equal to 10 is a highly aggressive water and would be very corrosive to almost all materials found in a typical water system, including residential plumbing. Such waters should be treated to increase pH or hardness to protect the entire network of materials that make up the system. In the event such water treatment is not to be undertaken, the manufacturer of each item used in the water system should be consulted for recommendations regarding the use of the product in an extremely corrosive environment.

NOTE: The expression $\text{pH} + \log (AH)$ is a modification of the Langelier Index. It has been prepared so that the aggressiveness of the water may be determined easily. A reasonable comparison of the two would be as follows:

	$\text{pH} + \log (AH)$	Langelier Index
Highly aggressive water	<10.0	<-2.0
Moderately aggressive water	10.0 through 11.9	-2.0 through -0.1
Nonaggressive water	≥ 12.0	≥ 0

II.C.2 External water. Aggressiveness of external water (water within the soil environment) in relation to asbestos-cement pipe is shown in Table F.2.

The guidelines for the use of asbestos-cement pipe in nonsulfate acidic soils are based on minimum pH factors alone. Asbestos-cement pipe may or may not perform satisfactorily in acidic soil environments having pH values below those listed in Table F.2. To determine the suitability of asbestos-cement pipe in soils having lower pH values, each situation should be evaluated individually, taking into consideration all aspects of soil environment that affect corrosion of asbestos-cement pipe.

II.C.3 Nonacid-soluble sulfates—internal and external. Aggressiveness of nonacid- ($\text{pH} \geq 7.0$) soluble sulfates in water and soils is related to the type designation of asbestos-cement pipe suitable for such use, as shown in Table F.3. Sulfate aggressiveness in water and soil can be classified as indicated in Table F.4.

II.C.4 Acid-soluble sulfates—internal and external. Aggressiveness of acid- ($\text{pH} < 7.0$) soluble sulfate waters and soils to asbestos-cement pipe must be evaluated independently. Acid sulfate soils and waters, whether the acid is inorganic

Table F.1 Asbestos-Cement Pipe Type Recommended for Internal Water Aggressiveness

Internal Water Aggressiveness	Recommended Pipe Type*
Highly aggressive	†
Moderately aggressive	II
Nonaggressive	I and II

*Type I—no limit on uncombined calcium hydroxide; type II—1.0 percent or less uncombined calcium hydroxide.

†The serviceability of pipe for such applications should be established by the purchaser in conjunction with the manufacturer.

Table F.2 Aggressiveness of Nonsulfate Acidic Soils to Asbestos-Cement Pipe

Water Conditions Within the Soil Environment	Minimum pH of Acidic Soils When Using Asbestos-Cement Pipe	
	Type I	Type II
Essentially quiescent	5.0	4.0
Mildly fluctuating	5.5	5.0
Rapidly moving or grossly cyclic	6.3	5.5

Table F.3 Chemical Resistance of Asbestos-Cement Pipe to Nonacid (pH ≥ 7.0) Soluble Sulfates in Water and Soils

Type Designation	Chemical Resistance to Nonacid Soluble Sulfates in Water and Soils
I*	Will be attacked in various degrees by all but the nonaggressive levels of sulfate concentrations in waters and soils
II	Resistant to all levels of soluble sulfates

*The guideline criteria for sulfate resistance of type I pipe were taken from the *Concrete Manual*, 8th edition, Bureau of Reclamation (1974). Sulfate resistance here applies to all soluble sulfates regardless of the cation.

Table F.4 Sulfate Aggressiveness in Water and Soil

Sulfate Aggressiveness Classification	Water	Soil
	Water-Soluble Sulfates—mg/L SO ₄	Water-Soluble Neutral Sulfates—mg/L SO ₄
Nonaggressive	150 and less	1000 and less
Mildly aggressive	150–1500	1000–2000
Moderately aggressive	1500–10,000	2000–20,000
Highly aggressive	10,000 and greater	20,000 and greater

in Sec. II.C.2 and Sec. II.C.3 and must take into consideration soil permeability and other factors. For guidance, consult the manufacturer.

II.D Supplementary specifications. The following information summarizes the conditions and items that the purchaser should consider when preparing supplementary specifications and lists the sections in the standard where they may be found.

1. Standard used—that is, AWWA C402-89, Standard for Asbestos-Cement Transmission Pipe, 18 In. Through 42 In.* (450 mm Through 1050 mm), for Potable Water and Other Liquids.

2. Affidavit of compliance, if required (Sec. 1.4).

3. Type of pipe to be furnished (Sec. II.C and Sec. 2.3).†

4. Classification of pipe (Sec. 3.1).

5. Nominal inside diameter (Sec. 3.2).

6. Lineal feet to be furnished in standard and random lengths (Sec. 3.3).

7. Number, size, type, classification, lengths, and extent of machining of special short lengths (Sec. 3.3).

8. Whether inspection by the purchaser and special marking are required (Sec. 5.1 and Sec. 6.1.4).

III. Major Revisions. Major changes made to this revision of the standard include:

1. The history of the standard (Foreword, Sec. I) was edited to reflect the sequence of events leading to this edition of the standard.

2. A caveat has been added to Sec. II of the Foreword advising users to familiarize themselves with the new OSHA regulations related to employer exposure to airborne asbestos particles.

3. Sec. 1.5, Permeation, was added to advise users of potential permeation of the pipe by low molecular weight hydrocarbons and organic solvents.

4. Sec. 2.1, Composition, was revised to change the limit on organic materials in the finished pipe from “none” to “shall not contain more than 0.2 percent.”

*Current (1988) production in the United States is limited to a maximum size of 24 in. (610 mm).

†Current production in the United States is limited to type II pipe only.

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ANSI/AWWA C402-89
(Revision of ANSI/AWWA C402-84)

AWWA STANDARD FOR

ASBESTOS-CEMENT TRANSMISSION

PIPE, 18 IN. THROUGH 42 IN.

(450 mm THROUGH 1050 mm),

FOR POTABLE WATER AND OTHER

LIQUIDS

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard covers nine pressure classifications of type I and type II asbestos-cement pipe, 18 in. through 42 in. (450 mm through 1050 mm) in diameter, for underground installation to convey potable water and other liquids.

1.1.1 *Use.* Asbestos-cement transmission pipe is to be used in pipe systems having relatively predictable flows and few appurtenances, which permit reasonable hydraulic analyses, including those for surge pressures.

Sec. 1.2 Definitions

Under this standard, the following definitions shall apply:

1.2.1 *Inspection:* Inspection of the pipe and the tests by the inspector.

1.2.2 *Inspector:* The party representing the owner for determining the adequacy of materials workmanship and quality of the product, process, or procedure according to the requirements of the owner and the provisions of this standard.

1.2.3A *Lot, as used herein for pipe 20 in. (500 mm) in diameter and smaller:* All pipe of any one classification, type, and size manufactured on any one machine in 24 h, but not to exceed 300 lengths.

1.2.3B *Lot, as used herein for pipe larger than 20 in. (500 mm) in diameter:* All pipe of any one classification, type, and size manufactured on any one machine during a period of consecutive working days not exceeding seven days, but not to exceed 300 lengths.

1.2.4 *Manufacturer:* The party that manufactures or produces the material or product covered by this standard.

1.2.5 *Purchaser:* The party entering into a contract or agreement for the purchase of any materials or work to be performed in accordance with the provisions of this standard. A purchaser may or may not be the owner.

Sec. 1.3 References

This standard references the following documents. In their current edition, they form a part of this standard to the extent *set forth* herein. In any case of conflict, the requirements of this standard shall prevail.

ASTM* C500—Standard Test Methods for Testing Asbestos-Cement Pipe (Rev. A).

ASTM D1869—Standard Specification for Rubber Rings for Asbestos-Cement Pipe (R 1983).

AWWA C403-83—Standard Practice for the Selection of Asbestos-Cement Distribution Pipe, 4 In. Through 16 In. (100 mm Through 400 mm), for Water and Other Liquids.

Sec. 1.4 Affidavit of Compliance

The purchaser's supplemental specifications may require an affidavit of compliance from the manufacturer, whether factory inspection has been required or not, to the effect that the materials furnished under the purchaser's order comply with all applicable requirements of this standard.

Sec. 1.5 Permeation

The selection of materials is critical for water service and distribution piping in locations where there is likelihood the pipe will be exposed to significant concentrations of pollutants comprised of low molecular weight petroleum products or organic solvents or their vapors. Research has documented that pipe materials such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement; and elastomers, such as used in jointing gaskets and packing glands, may be subject to permeation by lower molecular weight organic solvents or petroleum products. If a water pipe must pass through such a contaminated area or an area subject to contamination, consult with the manufacturer regarding permeation of pipe walls, jointing materials, etc., *before* selecting materials for use in that area.

*American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

SECTION 2: MATERIALS

Sec. 2.1 Composition

Asbestos-cement pipe shall be composed of an intimate mixture of either (1) portland cement or portland blast furnace slag cement and asbestos fiber with or without silica, or (2) portland pozzolanic cement and asbestos fiber. Both (1) and (2) can be with or without the addition of curing agents. The pipe shall be formed under pressure and cured. The finished pipe shall not contain more than 0.2 percent organic materials.

Sec. 2.2 Physical Requirements

2.2.1 Flexural strength. Only improperly bedded and improperly installed small-diameter pipe is susceptible to adverse flexural loading. Therefore, there is no flexural requirement for large-diameter pipes. For guidance on stacking heights, consult the manufacturer.

2.2.2 Bursting strength. Each length of pipe and each coupling sleeve shall have sufficient strength to withstand the design internal pressure indicated for its classification in Table 1 when subjected to the hydrostatic test procedure set forth in this standard.

2.2.3 Crushing strength. Each length of pipe shall have sufficient strength to support the design external load indicated for its classification in Table 2 when subjected to the crushing test procedure set forth in this standard.

Sec. 2.3 Chemical Requirements

Pipe shall be designated as either type I or type II according to its content of uncombined calcium hydroxide as determined by the test procedures in this standard for uncombined calcium hydroxide. The requirements for each type are:

Type I—no limit on uncombined calcium hydroxide.

Type II—1.0 percent or less uncombined calcium hydroxide.

Table 1 Pipe Classification*

Classification	Design Internal Pressure	
	<i>psi</i>	<i>kPa</i>
30	300	2100
35	350	2400
40	400	2800
45	450	3100
50	500	3400
60	600	4100
70	700	4800
80	800	5500
90	900	6200

*kPa values were converted from psi and rounded to the nearest hundred.

Table 2 Design External Load,* lb/ft (kN/m)

Pipe Size		Classification									
in.	(mm)	30	35	40	45	50	60	70	80	90	
18	(450)	2500 (36)	3000 (44)	4000 (58)	5000 (73)	6500 (95)	8500 (124)	11,000 (161)	14,000 (204)	18,000 (263)	
20	(500)	2500 (36)	3500 (51)	4500 (66)	5500 (80)	7100 (104)	9500 (139)	12,000 (175)	15,000 (219)	20,000 (292)	
21	(525)	2500 (36)	3500 (51)	4500 (66)	5800 (85)	7300 (107)	9700 (142)	12,500 (182)	16,000 (234)	21,000 (306)	
24	(600)	2800 (41)	3800 (55)	5000 (73)	6200 (90)	8100 (118)	11,000 (161)	15,000 (219)	19,000 (277)	24,000 (350)	
27	(675)	3500 (51)	4200 (61)	5500 (80)	7000 (102)	8800 (128)	12,500 (182)	16,500 (241)	20,500 (299)	27,000 (394)	
30	(750)	3500 (51)	4500 (66)	6000 (88)	7500 (109)	9700 (142)	13,500 (197)	18,000 (263)	22,500 (328)	30,000 (438)	
33	(825)	3500 (51)	5000 (73)	6500 (95)	8000 (117)	10,500 (153)	14,500 (212)	19,500 (285)	25,500 (372)	33,000 (482)	
36	(900)	4000 (58)	5000 (73)	7000 (102)	8000 (117)	11,200 (163)	16,000 (234)	21,000 (306)	26,000 (379)	36,000 (525)	
39	(975)	4200 (61)	5300 (77)	7500 (109)	9700 (142)	12,000 (175)	17,200 (251)	21,500 (314)	28,000 (409)	39,000 (569)	
42	(1050)	4300 (63)	5700 (83)	8000 (117)	10,500 (153)	13,000 (190)	18,500 (270)	24,000 (350)	30,000 (438)	42,000 (613)	

*It is necessary to apply a load factor to the above three-edge bearing loads to correlate them to the field loads (see AWWA C403, Standard Practice for the Selection of Asbestos-Cement Transmission and Feeder Main Pipe, Sizes 18 In. Through 42 In. [450 mm Through 1050 mm]).

SECTION 3: DESIGN

Sec. 3.1 Pipe Classifications

Pipe supplied under this standard shall be made according to one or more of the classifications shown in Table 1. (The numerical value for each classification is equivalent to one tenth of the hydrostatic test pressure.)

Sec. 3.2 Pipe Diameters

Pipe shall be made with nominal inside diameters of 18 in. (450 mm), 20 in. (500 mm), 21 in. (525 mm), 24 in. (600 mm), 27 in. (675 mm), 30 in. (750 mm), 33 in. (825 mm), 36 in. (900 mm), 39 in. (975 mm), and 42 in. (1050 mm). The average inside diameter of a standard or random pipe length shall not be less than the nominal diameter by more than 1.5 percent.

Sec. 3.3 Pipe Lengths

Pipe shall be produced in standard, random, and short lengths. At least 90 percent of the total footage of pipe of any classification, type, and size, excluding short lengths, shall be furnished in standard lengths. The remaining 10 percent may be in random lengths.

3.3.1 Standard nominal length. Pipe is customarily furnished in standard lengths of 13 ft (4 m), unless otherwise agreed at the time of purchase. A maximum of 10 percent of each pipe size may be furnished in random lengths of not less than 7 ft (2 m). Short lengths for making connections to valves, fittings, or structures and for making closures shall be made available. Table 3 lists the length tolerances.

Sec. 3.4 Couplings

A coupling shall consist of (1) an asbestos-cement sleeve of the same type and classification as the pipe, together with two rubber rings; or (2) a device that has bonding characteristics, strength, and serviceability that are equal to or better than an asbestos-cement coupling. Before manufacturing alternate devices, the manufacturer shall submit specifications and drawings of the proposed alternative to the purchaser for approval.

Table 3 Tolerances

Size of Pipe		Wall Thickness Tolerances		Length Tolerances	
in.	(mm)	in.	(mm)	in.	(mm)
18	(450)	-0.12	(-3.0)	±1	(±25.4)
20-24	(500-600)	-0.14	(-3.5)	±1	(±25.4)
27-30	(675-750)	-0.17	(-4.3)	±1	(±25.4)
33-36	(825-900)	-0.20	(-5.0)	±1	(±25.4)
39-42	(975-1050)	-0.23	(-5.8)	±1	(±25.4)

3.4.1 *Number of couplings.* One coupling of the same size and classification as the pipe shall be furnished with each standard and random length of pipe.

3.4.2 *Rubber rings.* Rubber rings shall conform to the requirements of ASTM D1869.

Sec. 3.5 Joints

Joints shall be capable of withstanding, without leakage, a hydrostatic pressure test as defined in Sec. 5.2.2.1.

Sec. 3.6 Wall Thickness

The wall thickness of the machined portion of any length of pipe shall not vary from the manufacturer's standard by more than the tolerance listed in Table 3.

SECTION 4: WORKMANSHIP AND FINISH

Sec. 4.1 Imperfections

4.1.1 *Interior surfaces.* The inside surface of each length of pipe shall be free from bulges, dents, and tears that result in a variation in diameter of more than 0.20 in. (5 mm) from the diameter of adjacent unaffected portions of the surface.

4.1.2 *Coupling areas.* The coupling areas of the barrel of each length of pipe shall be free from dents and gouges or other forms of damage that could cause leakage from the joint.

4.1.3 *Exterior surfaces.* Flaking on the exterior surface and edge of machined ends shall not extend back by more than 0.500 in. (12.7 mm) from the end, have a depth of more than 0.125 in. (3.2 mm), and shall not extend around the perimeter for more than 0.500 in. (12.7 mm) at any one location.

4.1.4 *Straightness.* Each length of pipe shall not vary in straightness by more than 0.05 in./ft (4.1 mm/m) of length when the variation is measured as follows:

Measure the maximum ordinate from the exterior surface of the pipe by placing a straightedge that exceeds the pipe length against the exterior surface and measure the maximum distance from the exterior pipe surface to the straightedge.

SECTION 5: INSPECTION, TESTING, AND REJECTION

Sec. 5.1 Inspection

5.1.1 *General.* Inspection by the purchaser shall not relieve the manufacturer of the responsibility to furnish material, finished pipe, and appurtenances conforming to the requirements of this standard.

5.1.2 *Notification.* If inspection by the purchaser is specified, the manufacturer shall notify the purchaser, in advance, of the date, time, and place of testing of the pipe, so that the purchaser may be represented at the test.

5.1.3 *Access.* The inspector shall have free access to those parts of the manufacturer's plant that are involved in work performed under this standard. The manufacturer shall afford the inspector, without charge, all reasonable facilities for determining whether the pipe meets the requirements of this standard.

5.1.4 *Testing.* If inspection by the purchaser is specified, the purchaser may, at his or her option, witness any or all tests. The pipe to be tested shall have passed the routine inspection and testing as stated in this standard. The number of tests to be conducted for hydrostatic bursting strength (lot test) and, when required, crushing strength shall be limited to one test per each 300 standard lengths of each size, type, and classification of pipe on the order. If uncombined calcium hydroxide tests are required, the number of tests will be one test for each size, type, and classification of pipe on the order. The purchaser or his or her authorized inspector may select the pipe to be tested. Retesting and rejection as shown in Sec. 5.3 shall apply.

Sec. 5.2 Physical Test Requirements

5.2.1 *Test specimens.* All pipes and couplings tested under this standard shall be in a normal, air-dried condition when tested.

5.2.2 *Hydrostatic tests.*

5.2.2.1 Each standard, random, or short length of pipe and each coupling sleeve shall be subjected to an internal hydrostatic test pressure equivalent to the proof-test pressure indicated in Table 4. Hydrostatic tests shall be conducted in accordance with hydrostatic proof test requirements of the latest edition of ASTM C500. Any pipe length or coupling sleeve showing leakage, sweating, or other defects shall be rejected. The test pressure shall be maintained for at least 5 s.

Table 4 Hydrostatic Tests

Classification	Proof Test		Lot Test	
	psi	(kPa)	psi	(kPa)
30	225	(1551)	300	(2100)
35	263	(1813)	350	(2400)
40	300	(2068)	400	(2800)
45	338	(2330)	450	(3100)
50	375	(2586)	500	(3400)
60	450	(3103)	600	(4100)
70	525	(3620)	700	(4800)
80	600	(4137)	800	(5500)
90	675	(4654)	900	(6200)

5.2.2.2 From each lot that has passed the hydrostatic proof test, a 1-ft (300-mm) or longer length of pipe shall be cut from the unmachined portion of a pipe. The unmachined sample shall withstand the hydrostatic lot test shown in Table 4 when tested in the manner set forth in Sec. 5.2.2.1, except that the test pressure need not be held for 5 s. If inspection by the purchaser has been specified, the length of pipe to be tested may be selected by the inspector.

5.2.3 *Flexural testing.* No flexural testing is required.

5.2.4 *Crushing tests.* On lots containing more than 100 lengths of each size and class, one length from each 300 lengths or fraction thereof shall be tested for crushing strength. If inspection by the purchaser has been specified, the length of pipe to be tested may be selected by the inspector. From each selected length, one unmachined section of pipe 1-ft (300-mm) long shall be cut. This section shall be tested for crushing strength in accordance with the three-edge, vee-shaped bearing test listed in the latest edition of ASTM C500. The test section shall not fail until the total load applied meets or exceeds the applicable value shown in Table 2.

5.2.5 *Machines for testing.*

5.2.5.1 The machine used for the hydrostatic test shall have gaskets that seal the ends of the pipe, coupling, or pipe and coupling with factory-assembled joint, but shall exert no end pressure. Couplings may be hydrostatically tested with a rubber bladder inside the coupling and, if so tested, each coupling shall have sufficient strength to withstand the lot test pressure indicated in Table 4.

5.2.5.2 The machines used for the crushing test shall be substantial and rigid throughout so that the distribution of the load will not be appreciably affected by the deformation or yielding of any part of the machine.

Sec. 5.3 Retests (Physical) and Rejection

5.3.1 *Crushing strength.* The failure of any specimen tested for crushing strength to support 75 percent of the crushing load required in Table 2 shall be cause for rejection of that portion of the lot of that size, type, and class manufactured during the same shift as the test specimen. If any specimen tested for crushing strength supports more than 75 percent, but less than 100 percent of the crushing load, two additional pipe sections of the same size, type, and class manufactured during the same shift shall be subjected to the same crushing test. The additional lengths may be selected by the inspector if inspection by the purchaser has been specified. The failure of one of these additional specimens to meet the full crushing-strength requirement shall be cause for rejection of that portion of the lot of that size, type, and class manufactured during the same shift as the test specimen.

5.3.2 *Hydrostatic tests.* If any pipe subjected to the hydrostatic tests set forth in Sec. 5.2.2.2 fails to withstand the specified pressure, two additional lengths of the same size and class manufactured during the same shift shall be subjected to the same hydrostatic test. The failure of one of these additional lengths to withstand the specified pressure shall be cause for rejection of that portion of the lot of that size, type, and class manufactured during the same shift as the test lengths.

Sec. 5.4 Test for Uncombined Calcium Hydroxide

The manufacturer shall perform the test for uncombined calcium hydroxide as often as necessary to ensure compliance with the requirements for uncombined calcium hydroxide in type II pipe. The uncombined calcium hydroxide test shall be conducted in accordance with the requirements of ASTM C500.

Sec. 5.5 Test Records

The results of all tests shall be recorded and retained for one year, and shall be available to the purchaser at the place of manufacture.

SECTION 6: MARKING AND DELIVERY

Sec. 6.1 Marking

6.1.1 *Standard and random lengths.* The outside surface of each standard or random length of pipe shall be clearly marked with the trade name, nominal inside diameter, classification, type, date, and shift of manufacture, and the word *Transmission*.

6.1.2 *Short lengths.* The outside surface of each short length of pipe shall be clearly marked on the outside surface with the nominal inside diameter, the classification, the letter *T* to indicate that it has been hydrostatically tested, and the word *Transmission*.

6.1.3 *Couplings.* All component parts of each coupling shall be clearly marked for use with the pipe for which they are intended. Each coupling shall also be marked with the letter *T* to indicate that it has been hydrostatically tested.

6.1.4 *Special markings.* If factory inspection is made by the purchaser or his or her inspector, each pipe and each coupling shall receive an additional special marking of no more than three letters, as specified by the purchaser.

Sec. 6.2 Preparation for Shipment

Unless otherwise specified, all pipe and couplings shall be prepared for standard commercial shipment.

APPENDIX A

Fittings For Use With Asbestos-Cement Transmission Pipe

This appendix is for information only and is not a part of AWWA C402.

Fittings for use with asbestos-cement transmission pipe should be made of materials that will provide service similar to asbestos-cement transmission pipe manufactured in accordance with this standard. The fitting manufacturer should select suitable fitting dimensions and tolerances that will provide a watertight joint with the pipe. Rubber rings for these fittings shall conform to the requirements of the latest edition of ASTM D1869.

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SUPERSEDING
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Department of Defense Acceptance Notice

AWWA C402-89 was adopted on 21 March 1990 and is approved for use by the Department of Defense (DoD). AWWA has furnished the clearance required by existing regulations. Copies of this document are stocked by the DoD Single Stock Point, Military Specifications and Standards, Bldg. 40, 700 Robbins Ave., Philadelphia, PA 19111-5094, for issue to DoD activities only. All other requestors must obtain documents from AWWA, 6666 West Quincy Ave., Denver, CO 80235.

Title of Document: American Water Works Association Standard for Asbestos-Cement Transmission Pipe, 18 In. Through 42 In. (450 mm Through 1050 mm), for Potable Water and Other Liquids

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