



Designation: **C14—15a C14 – 20**

Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe¹

This standard is issued under the fixed designation C14; 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 U.S. Department of Defense.

1. Scope

1.1 This covers nonreinforced concrete pipe intended to be used for the conveyance of sewage, industrial wastes, storm water, and for the construction of culverts.

1.2 A complete metric companion to Specification C14 has been developed—C14M; therefore, no metric equivalents are presented in this specification.

NOTE 1—This specification is a manufacturing and purchase specification only and does not include requirements for bedding, backfill, or the relationship between field load conditions and the strength classification of pipe. However, experience has shown that the successful performance of this product depends upon the proper selection of the class of pipe, type of bedding and backfill, and care that the installation conforms to the construction specifications. The owner is cautioned that he must correlate the field requirements with the class of pipe specified and provide for or require inspection at the construction site.

1.3 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

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

C33/C33M Specification for Concrete Aggregates

C150/C150M Specification for Portland Cement

C260/C260M Specification for Air-Entraining Admixtures for Concrete

C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

C443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C494/C494M Specification for Chemical Admixtures for Concrete

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

C595/C595M Specification for Blended Hydraulic Cements

C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C822 Terminology Relating to Concrete Pipe and Related Products

C989/C989M Specification for Slag Cement for Use in Concrete and Mortars

C1017/C1017M Specification for Chemical Admixtures for Use in Producing Flowing Concrete

C1116/C1116M Specification for Fiber-Reinforced Concrete

C1602/C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

3. Terminology

3.1 *Definitions*—For definitions of terms relating to concrete pipe, see Terminology C822.

¹ This specification is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.01 on Non-Reinforced Concrete Sewer, Drain and Irrigation Pipe.

Current edition approved Oct. 1, 2015 May 1, 2020. Published October 2015 May 2020. Originally approved in 1917. Last previous edition approved in 2015 as C14 – 15-C14 – 15a. DOI: 10.1520/C0014-15A-10.1520/C0014-20.

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.

4. Classification

4.1 Pipe manufactured according to this specification shall be of three classes identified as “Class 1 Nonreinforced Concrete Pipe,” “Class 2 Nonreinforced Concrete Pipe,” and “Class 3 Nonreinforced Concrete Pipe.” The corresponding strength requirements are prescribed in [Table 1](#).

5. Basis of Acceptance

5.1 The acceptability of the pipe shall be determined by the results of the test prescribed in this section, when required, and by inspection to determine whether the pipe conforms to this specification as to design and freedom from defects.

5.2 *Acceptance as to Strength Properties*—Pipe shall be acceptable under the strength tests when they have met the requirements as prescribed in [+0:310.2](#).

5.3 *Acceptance as to Absorption Properties*—Pipe shall be acceptable under the absorption test when they have met the requirements as prescribed in [+0:410.3](#).

5.4 *Acceptance as to Permeability Properties*—Pipe shall be acceptable under the permeability test when they have met the requirements as prescribed in [+0:510.4](#).

NOTE 2—Prior to purchase, the owner has the option to specify the hydrostatic test prescribed in [+0:610.5](#) instead of the permeability test.

5.5 *Acceptance as to Hydrostatic Properties*—Pipe shall be acceptable under the hydrostatic test when they have met the requirements as prescribed in [+0:610.5](#).

6. Materials

6.1 *Concrete*—The concrete shall consist of cementitious materials, mineral aggregates, admixtures, if used, and water.

6.2 *Cementitious Materials:*

6.2.1 *Cement*—Cement shall conform to the requirements for portland cement of Specification [C150/C150M](#) or shall be portland blast-furnace slag cement, portland-limestone cement, or portland-pozzolan cement conforming to the requirements of Specification [C595/C595M](#), except that the pozzolan constituent in the Type IP portland-pozzolan cement shall be fly ash.

6.2.2 *Fly Ash*—Fly ash shall conform to the requirements of Specification [C618](#), Class F or Class C.

6.2.3 *Slag Cement*—Slag cement shall conform to the requirements of Grade 100 or 120 of Specification [C989/C989M](#).

6.2.4 *Allowable Combinations of Cementitious Materials*—The combination of cementitious materials used in the concrete shall be one of the following:

6.2.4.1 Portland cement only,

6.2.4.2 Portland blast-furnace slag cement only,

6.2.4.3 Portland-pozzolan cement only,

6.2.4.4 Portland-limestone cement only,

6.2.4.5 A combination of portland cement or portland-limestone cement and fly ash,

6.2.4.6 A combination of portland cement or portland-limestone cement and slag cement,

6.2.4.7 A combination of portland cement or portland-limestone cement, fly ash, and slag cement, or

6.2.4.8 A combination of portland-pozzolan cement and fly ash.

6.3 *Aggregates*—Aggregates shall conform to Specification [C33/C33M](#), except that the requirement for gradation shall not apply.

TABLE 1 Physical and Dimensional Requirements for Nonreinforced Concrete Pipe^A

Internal Designated Diameter, in.	Class 1		Class 2		Class 3	
	Minimum Thickness of Wall, in.	Minimum Three-Edge Bearing Strength, lbf/linear ft	Minimum Thickness of Wall, in.	Minimum Three-Edge Bearing Strength, lbf/linear ft	Minimum Thickness of Wall, in.	Minimum Three-Edge Bearing Strength, lbf/linear ft
4	5/8	1500	3/4	2000	3/4	2400
6	5/8	1500	3/4	2000	7/8	2400
8	3/4	1500	7/8	2000	1 1/8	2400
10	7/8	1600	1	2000	1 1/4	2400
12	1	1800	1 3/8	2250	1 3/4	2600
15	1 1/4	2000	1 5/8	2600	1 7/8	2900
18	1 1/2	2200	2	3000	2 1/4	3300
21	1 3/4	2400	2 1/4	3300	2 3/4	3850
24	2 1/8	2600	3	3600	3 3/8	4400
27	3 1/4	2800	3 3/4	3950	3 3/4	4600
30	3 1/2	3000	4 1/4	4300	4 1/4	4750
33	3 3/4	3150	4 1/2	4400	4 1/2	4875
36	4	3300	4 3/4	4500	4 3/4	5000

^ASubject to tolerances in Section 11.

6.4 *Admixtures*—The following admixtures and blends are allowable:

6.4.1 Air-entraining admixture conforming to Specification **C260/C260M**;

6.4.2 Chemical admixture conforming to Specification **C494/C494M**;

6.4.3 Chemical admixture for use in producing flowing concrete conforming to Specification **C1017/C1017M**; and

6.4.4 Chemical admixture or blend approved by the owner.

6.5 *Fibers*—Synthetic fibers and Non-Synthetic fibers shall be allowed to be used, at the manufacturer's option, in concrete pipe as a nonstructural manufacturing material. Synthetic fibers (Type II and Type III) and Non-Synthetic fiber (Type I) designed and manufactured specifically for use in concrete and conforming to the requirements of Specification **C1116/C1116M** shall be accepted.

6.6 *Water*—Water used in the production of concrete shall be potable or nonpotable water that meets the requirements of Specification **C1602/C1602M**.

7. Design

7.1 *Design Tables*—Design requirements shall be in accordance with **Table 1**. Wall thickness used shall be not less than the value shown, except as affected by the tolerance herein specified and by the provision for modified design.

7.2 *Modified or Special Design*—Manufacturers shall submit to the owner for approval, prior to manufacture, wall thicknesses other than those shown in **Table 1**. Such pipe shall meet all of the physical requirements listed in Section **10** that are specified by the owner.

8. Joints

8.1 The joints shall be of such design and the ends of the concrete pipe sections so formed, that the pipe can be laid together to make a continuous line of pipe compatible with the permissible variations given in Section **11**.

9. Manufacture

9.1 *Mixture*—The aggregates shall be sized, graded, proportioned, and mixed with such proportions of cementitious materials, water, and admixtures, if any, to produce a thoroughly mixed concrete of such quality that the pipe will conform to the test and design requirements of this specification. All concrete shall have a water-cementitious materials ratio not exceeding 0.53 by weight. Cementitious materials shall be as specified in **6.2** and shall be added to the mix in a proportion not less than 470 lb/yd³ unless mix designs with a lower cementitious material content demonstrate that the quality and performance of the pipe meet the requirements of this specification.

9.2 *Curing*—Pipe shall be subjected to any one of the methods of curing described in **9.2.1**, **9.2.2**, **9.2.3**, **9.2.4**, or to any other method or combination of methods approved by the owner that will give satisfactory results. The pipe shall be adequately cured to obtain the strength properties as described in **5.2**.

9.2.1 *Steam Curing*—Pipe shall be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained by the injection of steam for such time and such temperature as needed to enable the pipe to meet the strength requirements. The curing chamber shall be so constructed as to allow full circulation of steam around the entire pipe.

9.2.2 *Water Curing*—Concrete pipe shall be water-cured by covering with water-saturated material or by a system of perforated pipes, mechanical sprinklers, porous hose, or by any other approved method that will keep the pipe moist during the specified curing period.

9.2.3 The manufacturer is not prohibited from combining the methods described in **9.2.1** and **9.2.2** provided the specified strength is attained.

9.2.4 *Membrane Curing*—A sealing membrane conforming to the requirements of Specification **C309** is not prohibited from being applied and left intact until the specified strength requirements are met. The concrete at the time of application shall be within 10°F of the atmospheric temperature. All surfaces shall be kept moist prior to the application of the compounds and shall be damp when the compound is applied.

9.3 *Specials*:

9.3.1 *General Requirements*—Special shapes or fittings such as wyes, tees, bends, and adapters for use with concrete pipe conforming to this specification shall conform to the applicable requirements for concrete pipe of corresponding class and internal diameter. Joints shall be compatible with those used in adjoining concrete pipes.

9.3.2 *Fabricated Branches*—Fabricated branches for wyes and tees shall be securely attached to the wall of the pipe in such a manner as not to restrict or otherwise interfere with the flow characteristics of the pipe.

10. Requirements

10.1 *Test Specimen*—The specified number of pipe required for the tests shall be furnished by the manufacturer and shall be selected at random by the owner, and shall be pipe that would not otherwise be rejected under this specification. The selection shall be made at the point or points designated by the owner when placing the order. The test pipe shall first be freed from all visible moisture. When dry, each pipe shall be measured and inspected. The results of these observations shall be recorded.