



Designation: C118 – 11

Standard Specification for Concrete Pipe for Irrigation or Drainage¹

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1. Scope

1.1 This specification covers nonreinforced concrete pipe to be used for the conveyance of irrigation water with working pressures, including hydraulic transients, as shown in **Table 1** and for use in drainage.

1.2 A complete SI companion to Specification C118 has been developed—C118M; therefore, no SI equivalents are presented in this specification.

NOTE 1—This specification is for manufacturing and purchase only and does not include requirements for bedding, backfill, installation, or field repairs. The owner is cautioned that he must correlate field conditions with the characteristics of the pipe specified and provide inspection during installation.

2. Referenced Documents

2.1 *ASTM Standards*:²

C33 Specification for Concrete Aggregates

C150 Specification for Portland Cement

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

C595 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 Specification for Slag Cement for Use in Concrete and Mortars

C1116/C1116M Specification for Fiber-Reinforced 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.

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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.

4. Classification

4.1 Pipe manufactured according to this specification shall be known as “ASTM Standard Concrete Irrigation Pipe,” “ASTM Standard Concrete Drainage Pipe,” or “ASTM Heavy-Duty Concrete Drainage Pipe.”

5. Basis of Acceptance

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

6. Materials

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

6.2 *Cementitious Materials*:

6.2.1 *Cement*—Cement shall conform to the requirements for portland cement of Specification **C150** or shall be portland blast-furnace slag cement, or slag modified portland cement, or portland-pozzolan cement conforming to the requirements of Specification **C595**, 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 *Ground Granulated Blast Furnace Slag (GGBFS)*—GGBFS shall conform to the requirements of Grade 100 or 120 of Specification **C989**.

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 Slag modified portland cement only,

6.2.4.4 Portland pozzolan cement only,

6.2.4.5 A combination of portland cement and fly ash,

6.2.4.6 A combination of portland cement and ground granulated blast-furnace slag, or

6.2.4.7 A combination of portland cement, fly ash (not to exceed 25 % of the total cementitious weight) and ground granulated blast furnace slag (not to exceed 25 % of the total cementitious weight).

TABLE 1 Standard Dimensions, Working Pressure, and Test Requirements for Standard Concrete Irrigation Pipe^A

Internal Designated Diameter, in.	Thickness of Wall, T, in.	Working Pressure, ^B ft	Minimum Internal Hydrostatic Test Pressure, psi	Minimum Three-Edge-Bearing Load, lbf/linear ft
6	7/8	30	50	1300
8	1	30	50	1350
10	1 1/8	30	50	1400
12	1 1/4	25	45	1500
14	1 3/8	25	45	1600
15	1 1/2	25	45	1650
16	1 1/2	25	45	1700
18	1 3/4	25	45	1800
20	2	25	40	1850
21	2 1/8	25	40	1900
24	2 1/4	25	40	2000

^A For hydrostatic test requirements, refer to 10.5.

^B Higher working pressures are not prohibited up to a maximum of 40 ft for 6 through 8-in. diameters, 35 ft for 10 through 12-in. diameters, and 30 ft. for 14-in. through 24-in. diameters. In these cases, the strength of the pipe shall be increased to give a minimum of at least four times the design working pressure when tested as specified in 10.5.

6.3 *Aggregates*—Aggregates shall conform to Specification C33, except that the requirements for gradation shall not apply.

6.4 *Admixtures and Blends*—Owner is not prohibited from obtaining the record of mix design used.

6.5 *Synthetic Fibers*, Collated fibrillated virgin polypropylene fibers are not prohibited in concrete pipe as a nonstructural manufacturing material. Only Type III synthetic fibers designed and manufactured specifically for use in concrete and conforming to the requirements of Specification C1116/C1116M shall be accepted.

7. Design

7.1 *Design Tables*—Design requirements shall be in accordance with Table 1 for standard concrete irrigation pipe or with the applicable part of Table 2 for concrete drainage pipe. Wall thicknesses used shall be not less than the values shown, except as affected by the tolerances herein specified and by the provision for alternative design.

TABLE 2 Physical Test Requirements for Standard and Heavy-Duty Concrete Drainage Pipe^A

Internal Designated Diameter, in.	Standard Drainage Pipe		Heavy-Duty Drainage Pipe	
	Thickness of Wall, in.	Minimum Three-Edge-Bearing Load, lbf/linear ft	Thickness of Wall, in.	Minimum Three-Edge-Bearing Load, lbf/linear ft
4	3/4	1200	3/4	1400
5	3/4	1250	3/4	1400
6	7/8	1300	7/8	1400
8	1	1350	1	1500
10	1 1/8	1400	1 1/8	1550
12	1 1/4	1500	1 1/4	1700
14	1 3/8	1600	1 1/2	1850
15	1 1/2	1650	1 1/2	1980
16	1 1/2	1700	1 5/8	2100
18	1 3/4	1800	2	2340
20	2	1850	2 1/4	2500
21	2 1/8	1900	2 1/4	2680
24	2 1/4	2000	2 1/2	3000

^A For absorption test requirements, refer to 10.4.

7.2 *Modified Design*—Manufacturers shall submit to the owner for approval prior to manufacture, wall thicknesses other than those shown in Table 1 or Table 2. Such pipe shall meet all of the test and performance requirements specified by the owner in accordance with Section 10.

7.3 *Laying Lengths*—Unless otherwise specified by the owner when calling for bids, maximum lengths of individual units of drainage pipe shall not exceed 30 in. for sizes 4 in. through 6 in., 36 in. for sizes 8 in. through 15 in., and 48 in. for larger sizes.

8. Joints

8.1 The joints of both irrigation and drainage pipe 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.

8.1.1 The joints of concrete drain tile shall conform to 8.1 without the use of mortar or other jointing material and allow water to enter without permitting the entrance of deleterious amounts of solids.

9. Concrete Mixture

9.1 The aggregates shall be sized, graded, proportioned, and thoroughly mixed with such proportions of cementitious materials and water as will produce a homogeneous concrete mixture of such quality that the pipe will conform to the test and design requirements of this specification.

10. Physical Requirements

10.1 *Test Specimens*—Specimens for tests shall be full-size pipe which shall in every respect conform to the inspection requirements prescribed in this specification.

10.2 *Number and Type of Tests Required:*

10.2.1 The specimens to be tested shall be selected at random by the owner at the place of manufacture, and shall be tested in advance of shipment. The manufacturer shall furnish specimens for purpose of tests, without charge, up to 0.5 % of the number of pipe of each size included in the order, except that in no case shall less than two specimens be furnished, the manufacturer bearing all expense of testing each pipe. Should a larger number of specimens be tested upon demand of the owner or manufacturer, then the cost of such additional test specimens and the expense of testing shall be borne by the party making such demand.

10.2.2 The owner shall specify the proportion of irrigation pipe specimens that shall be subjected to the three-edge-bearing load tests, and the proportion that shall be subjected to the hydrostatic test.

10.2.3 All drainage pipe to be tested shall be subjected to the three-edge-bearing load tests, and one half of the number of pipe so tested shall be subjected to the Test Method A or Test Method B absorption test in accordance with Test Methods C497, or other absorption test approved by the owner.

10.3 *External Load Test Requirements*—The pipe, when tested in accordance with Test Methods C497 shall sustain the load prescribed in Table 1 or Table 2 for each respective size and class of pipe.