



Designation: C 118M – 99  
METRIC

# Standard Specification for Concrete Pipe for Irrigation or Drainage [Metric]<sup>1</sup>

This standard is issued under the fixed designation C 118M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 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 This specification is the SI counterpart of Specification C 118.

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:

- C 33 Specification for Concrete Aggregates<sup>2</sup>
- C 150 Specification for Portland Cement<sup>3</sup>
- C 497M Test Methods for Concrete Pipe, Manhole Sections, or Tile [Metric]<sup>4</sup>
- C 595 Specification for Blended Hydraulic Cements<sup>3</sup>
- C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete<sup>2</sup>
- C 822 Terminology Relating to Concrete Pipe and Related Products<sup>4</sup>
- C 1116 Specification for Fiber-Reinforced Concrete and Shotcrete<sup>2</sup>

## 3. Terminology

3.1 *Definitions*—For definitions of terms relating to concrete pipe, see Terminology C 822.

## 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.”

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.01 on Reinforced Concrete Sewer, Drain, and Irrigation Pipe.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.05.

TABLE 1 Standard Dimensions, Working Pressure, and Test Requirements for Standard Concrete Irrigation Pipe<sup>A</sup>

Internal Designated Diameter, mm	Thickness of Wall, T, mm	Working Pressure, <sup>B</sup> kPa	Minimum Internal Hydrostatic Test Pressure, kPa	Minimum Three-Edge-Bearing Load, kN/linear m
150	22	90	345	19.0
200	25	90	345	19.5
250	29	90	345	20.5
300	32	75	310	22.0
350	35	75	310	23.5
375	38	75	310	24.0
400	38	75	310	25.0
450	44	75	310	26.5
500	50	75	275	27.0
525	54	75	275	27.5
600	57	75	275	29.0

<sup>A</sup>For hydrostatic test requirements, refer to 10.5.

<sup>B</sup>Higher pressures may be used up to a maximum of 120 kPa for 150 through 200-mm diameters, 105 kPa for 250 through 300-mm diameters, and 90 kPa for 350 through 600-mm diameters. In these cases, the strength of the pipe shall be increased to give a minimum internal hydrostatic test pressure of at least four times the design working pressure when tested as specified in 10.5.

## 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 C 150 or shall be portland blast-furnace slag cement or portland-pozzolan cement conforming to the requirements of Specification C 595, 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 C 618, Class F or Class C.

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

6.2.3.1 Portland cement only,

6.2.3.2 Portland blast furnace slag cement only,

6.2.3.3 Portland pozzolan cement only, or

6.2.3.4 A combination of portland cement and fly ash.

6.3 *Aggregates*—Aggregates shall conform to Specification C 33, except that the requirements for gradation shall not apply.

6.4 *Admixtures and Blends*—Admixtures and blends may be used with the approval of the owner.

6.5 *Synthetic Fibers*—Collated fibrillated virgin polypropylene fibers may be used, at the manufacturer's option, 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 C 1116 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 may be more than but not less than the values shown, except as affected by the tolerances herein specified and by the provision for alternative design.

7.2 *Modified Design*—Manufacturers may 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 750 mm for sizes 100 mm through 150 mm, or 900 mm for sizes 200 mm through 375 mm, and 1200 mm 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 C 497M, or other absorption test approved by the owner.

10.3 *External Load Test Requirements*—The pipe, when tested in accordance with Test Methods C 497M shall sustain the load prescribed in Table 1 or Table 2 for each respective size and class of pipe.

10.3.1 Sand or other loose fine material may be spread along the length of the crown of the pipe to equalize the upper bearing. Pipe having exterior surface irregularities may have the depressions filled with plaster of paris to equalize the bearing surfaces. If mutually agreed upon between the manufacturer and the owner, other types of bearings such as hard rubber blocks or sand-filled high-pressure hose may be used.

10.3.2 The load shall be applied continuously until the strength specified in Table 1 or 2 is reached. The pipe shall not be allowed to stand under load longer than is required to apply the load and to observe and record it. The pipe shall be surface-dry when tested. Tests shall not be made on frozen pipe.

10.4 *Absorption Test*—Test specimens shall be subjected to the boiling absorption test in accordance with Test Methods C 497M. For Test Method A, three test specimens shall be taken from each pipe unit to be tested; one of the pieces shall be taken from one end of the pipe, another piece from the opposite end, and the third piece from near the center. For Test Method A, each test specimen shall be free of visible cracks,

**TABLE 2 Physical Test Requirements for Standard and Heavy-Duty Concrete Drainage Pipe<sup>A</sup>**

Internal Designated Diameter, mm	Standard Drainage Pipe		Heavy-Duty Drainage Pipe	
	Thickness of Wall, mm	Minimum Three-Edge-Bearing Load, kN/linear m	Thickness of Wall, mm	Minimum Three-Edge-Bearing Load, kN/linear m
100	19	17.5	19	20.5
125	19	18.0	19	20.5
150	22	19.0	22	20.5
200	25	19.5	25	22.0
250	29	20.5	29	22.5
300	32	22.0	32	25.0
350	35	23.5	38	27.0
375	38	24.0	38	29.0
400	38	25.0	41	30.5
450	44	26.5	50	34.0
500	50	27.0	57	36.5
525	54	27.5	57	39.0
600	57	29.0	63	44.0

<sup>A</sup>For absorption test requirements, refer to 10.4.