



Designation: C444/C444M – 21

Standard Specification for Perforated Concrete Pipe¹

This standard is issued under the fixed designation C444/C444M; 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 specification covers perforated concrete pipe intended to be used for underdrainage.

1.2 The values stated in either inch-pound or SI units are to be regarded separately as standard. Within the text the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values may result in nonconformance with the specification.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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

C822 Terminology Relating to Concrete Pipe and Related Products

3. Terminology

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

4. Classification

4.1 Pipe manufactured according to this specification shall be of two classes known as Type 1 and Type 2, which cover

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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.

two arrangements of perforations to be used with pipe manufactured according to any of the standard specifications for plain or reinforced concrete pipe, and any of the classifications within those standard specifications.

4.1.1 Type 1 perforated pipe shall have circular perforations conforming to **6.1** and **Table 1**.

4.1.2 Type 2 perforated pipe shall have slotted perforations conforming to **6.2** and **Table 2**.

4.1.3 It is intended that perforated pipe shall be specified by reference to this specification and the specification for the type and class of pipe desired.

NOTE 1—*Example*—“Perforated concrete pipe shall conform to the requirements of Specification C444/C444M Type 2, and all applicable requirements of Specification C14, Class 2.”

5. Basis of Acceptance

5.1 The acceptability of the pipe shall be determined by the results of all applicable tests (**Note 2**) prescribed for the type and class of pipe specified, and by inspection to determine whether the pipe conforms to this specification as to design and freedom from defects.

NOTE 2—It is intended that all tests will be applicable except those having to do with permeability and the hydrostatic test.

6. Perforations

6.1 *Type 1*—Perforations shall be circular, not more than $\frac{5}{16}$ in. [8 mm] or less than $\frac{3}{16}$ in. [5 mm] in diameter, and arranged in rows parallel to the axis of the pipe. Perforations shall be 3 in. [75 mm] center-to-center, along rows, with no less than $\frac{1}{2}$ in. [13 mm] of cover over any reinforcing steel. The spigot or tongue end shall not be perforated for a length equal to the depth of the socket, or depth of the groove plus $\frac{3}{4}$ in. [19 mm] and perforations shall continue at uniform spacing along the entire length of the barrel. The total number of rows shall be as shown in **Table 1**. The rows shall be spaced over not more than 165° of circumference. Rows shall be symmetrically arranged with respect to the intended top or bottom of the pipe.

6.2 *Type 2*—Slots shall be circumferential in direction, not more than $\frac{3}{16}$ in. [5 mm] or less than $\frac{1}{8}$ in. [3 mm] in width, and of the lengths shown in **Table 2**. There shall be two rows of slots, spaced 165° apart, and centered, in the case of

TABLE 1 Number of Rows of Perforations Required

Internal Designated Diameter		Rows of Perforations
in. [mm]		
4 [100]		4
6 [150]		4
8 [200]		4
10 [250]		6
12 [300]		6
14 [350]		6
15 [375]		6
16 [400]		6
18 [450]		8
20 [500]		8
21 [525]		8
24 [600]		8
27 [675] and larger	space rows approximately 6 in. [150 mm]	

TABLE 2 Requirements for Length and Spacing of Slots

Internal Designated Diameter	Slot Length	Slot Spacing ^A
4 [100]	1 [25]	3 [75]
6 [150]	1½ [38]	3 [75]
8 [200]	2 [50]	4 [100]
10 [250]	2 [50]	4 [100]
12 [300]	3 [75]	6 [150]
14 [350]	3 [75]	6 [150]
15 [375]	3 [75]	6 [150]
16 [400]	3 [75]	6 [150]
18 [450]	3 [75]	6 [150]
20 [500]	3 [75]	6 [150]
21 [525]	3 [75]	6 [150]
24 [600]	3 [75]	6 [150]
27 [675] and larger	4 [100]	6 [150]

^ASee 6.2 for exceptions for plain-end pipe.

elliptically reinforced pipe, about the minor axis of the reinforcing. Slots shall be spaced as shown in Table 2, except as modified herein for plain-end pipe with no less than ½ in. [13 mm] cover over any reinforcing steel. The distance from the spigot end, or from the shoulder of the tongue end, to the first pair of slots shall be not more than 1 in. [25 mm] greater than the specified slot spacing. Slots shall continue at uniform spacing along the length of the barrel.

6.2.1 Slots in plain-end pipe shall be spaced as shown in Table 2 except that smaller spacing shall be used where necessary to provide not less than three equally spaced slots in each row. Slots shall be centered with respect to the ends of the pipe and there shall be not more than the specified slot spacing from the pipe end to the first pair of slots, or less than one half of the slot spacing employed.

6.3 *Type 3*—The allowable water area for openings other than Type 1 or Type 2 shall not be less than the equivalent opening areas shown in Table 1 and Table 2.

6.4 The manufacturer shall submit to the owner for approval, prior to manufacture, sizes, shapes, methods, and arrangements of perforations other than specified herein.

6.5 If perforations, slots, or other openings are more than ⅜ in. [5 mm] in diameter, the pipe shall be wrapped in a geotextile filter fabric prior to installation.

7. Joints

7.1 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 8.

8. Permissible Variation in Dimensions

8.1 The permissible variation in circular perforation size or slot width shall be as specified in Section 6. Slot length tolerance is +¼ in. [+6 mm] or -⅛ in. [-3 mm]. Variation in row spacing, or in the spacing of holes or slots in any row, shall be ±½ in. [±13 mm] except as required to provide specified cover for reinforcing steel.

9. Repairs

9.1 Pipe repaired because of imperfections in manufacture or damage during handling, will be acceptable, if in the opinion of the owner, the repairs are sound and properly finished and cured and the repaired pipe conforms to the requirements of this specification.

10. Marking of Rejected Specimens

10.1 All rejected pipe shall be marked clearly by the owner and shall be replaced by the manufacturer with pipe that will meet the requirements of this specification, without additional cost to the owner.

11. Inspection

11.1 The quality of all materials and the finished pipe shall be subject to inspection and approval by the owner. Such inspection shall be performed at the point of manufacture or delivery. The method of marking as to acceptance or rejection of the pipe shall be agreed upon, prior to inspection, between the owner and manufacturer. Rejected pipe shall be replaced by the manufacturer with pipe that meets the requirements of this specification.

12. Rejection

12.1 Pipe shall be subject to rejection on account of any of the applicable causes for rejection listed for the type and class of pipe specified, or on account of any of the following:

12.1.1 Variations in dimensions exceeding those specified in Sections 6 and 8, or

12.1.2 Any spall more than ½ in. [13 mm] from the edge of the slot or ¼ in. [6 mm] in depth caused by making perforations or slots.

13. Keywords

13.1 concrete pipe; perforated; subsurface drainage; underdrainage