



Designation: C 498 – 95

## Standard Specification for Perforated Clay Drain Tile<sup>1</sup>

This standard is issued under the fixed designation C 498; 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 Department of Defense.*

### 1. Scope

1.1 This specification covers perforated drain tile made from clay, shale, fire clay, or mixtures thereof, and fired. In this specification, the term perforated drain tile or tile shall mean tile made only from these materials.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

### 2. Referenced Documents

2.1 *ASTM Standards*:

C 4 Specification for Clay Drain Tile<sup>2</sup>

### 3. Classes

3.1 Four classes of drain tile are covered:

3.1.1 Standard Perforated Drain Tile,

3.1.2 Extra-Quality Perforated Drain Tile,

3.1.3 Heavy-Duty Perforated Drain Tile, and

3.1.4 Extra-Strength Perforated Drain Tile.

3.2 A higher strength class of perforated drain tile than specified by the purchaser may be furnished and shall be considered as meeting the specification for the class called for.

### 4. Materials, Workmanship, and Finish

4.1 Presence in drain tile of any minerals or chemicals that are known to cause slaking or disintegration of the tile shall be deemed valid grounds for rejection, unless satisfactory proof is submitted that the tile are durable and permanent.

4.2 Drain tile shall be free of cracks, checks, or chips extending into the body of the tile in such a manner as would decrease the strength appreciably. There shall be no breaks in the tile that would admit earth into the drain.

4.3 Drain tile shall be reasonably smooth on the inside and shall be approximately circular in cross section, except when otherwise specified in advance. Perforations shall be clean cut and there shall be no burrs projecting into the tile which would interfere with the free flow of water. Tile shall be approximately straight, except in the case of special connections. The

ends of butt-end tile shall be so regular and smooth as to make possible close joints by turning and pressing together the ends of adjoining tile. Butt-end tile shall be furnished unless otherwise specified by the purchaser.

4.4 Drain tile shall conform to the general physical characteristics prescribed in Table 1.

### 5. Physical Properties

5.1 Drain tile shall conform to the physical requirements for the class specified as prescribed in Table 2.

5.2 *Waiver of Absorption Requirements*—Requirements prescribed in Table 2 for water absorption (5 h boiling) shall be waived provided a sample consisting of five drain tile, meeting all other requirements, shows no disintegration or spalling and no loss in dry weight of any individual tile greater than 5 % when subjected to the freezing and thawing test, made as prescribed in Sections 17 to 19 of Specification C 4. The number of cycles of freezing and thawing to which each class of tile shall be subjected are:

Class	Number of Cycles
Standard	36
Extra-Quality	48
Heavy-Duty	48
Extra-Strength	48

If tile meet the requirements of the freezing and thawing test, the average percentage absorption of the specimens used in the test shall be adopted as the maximum allowable average absorption for the contract in question. At least 80 % of all tile tested shall meet the requirements prescribed in this paragraph.

### 6. Sizes of Tile and Perforations

6.1 *Diameter*—Sizes of drain tile shall be designated by their inside diameters.

6.2 *Lengths*—Drain tile smaller than 12 in. (305 mm) in diameter shall have a length not less than approximately 12 in. Tile 12 to 18 in. (305 mm to 457 mm) in diameter, inclusive, shall have nominal lengths not less than their diameters.

6.3 *Perforations*—Perforations shall be circular and cleanly cut, and shall be specified by the purchaser as either (1)  $\frac{1}{4} \pm \frac{1}{16}$  in. (6.4 ± 1.6 mm) or (2)  $\frac{1}{2} \pm \frac{1}{8}$  in. (12.7 ± 3.2 mm) in diameter, arranged in rows parallel to the axis of the tile. Perforations shall be not more than approximately 3 in. (76 mm) center to center, along rows, and the minimum number of

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.05.

**TABLE 1 Distinctive General Physical Properties of Clay Drain Tile**

Physical Properties Specified	Standard Perforated Drain Tile	Extra-Quality, Heavy-Duty and Extra-Strength Perforated Drain Tile
Permissible variation of average diameter below specified diameter, %	3	3
Permissible variation between maximum and minimum diameters of same tile, percentage of thickness of wall	75	65
Permissible variation of average length of tile sampled below manufacturer's specified length, %	3	3
Permissible variation from straightness, percentage of length	3	3
Permissible thickness of exterior blisters, lumps, and flakes which do not weaken tile and are few in number, percentage of thickness of wall	20	15
Permissible diameters of above blisters, lumps, and flakes, percentage of inside diameter	15	10
General inspection	rigid	very rigid

**TABLE 2 Physical Test Requirements for Perforated Clay Drain Tile**

Internal Diameter of Tile, in.	Standard Drain Tile		Extra-Quality Drain Tile				Heavy-Duty Drain Tile		Extra-Strength Drain Tile			
	Minimum Crushing Strength, <sup>A</sup> lbf/linear ft (kN/m)		Maximum Water Absorption by 5-h Boiling, <sup>B</sup> %		Minimum Crushing Strength, <sup>A</sup> lbf/linear ft (kN/m)		Maximum Water Absorption by 5-h Boiling, <sup>B</sup> %		Minimum Crushing Strength, <sup>A</sup> lbf/linear ft (kN/m)		Minimum Crushing Strength, <sup>A</sup> lbf/linear ft (kN/m)	
	Average of Five Tile	Individual	Average of Five Tile	Individual	Average of Five Tile	Individual	Average of Five Tile	Individual	Average of Five Tile	Individual	Average of Five Tile	Individual
4	800 (11.7)	680 (9.9)	13	16	1100 (16.0)	990 (14.4)	11	13	1400 (20.4)	1260 (18.4)	2000 (29.2)	1800 (26.3)
5	800 (11.7)	680 (9.9)	13	16	1100 (16.0)	990 (14.4)	11	13	1400 (20.4)	1260 (18.4)	2000 (29.2)	1800 (26.3)
6	800 (11.7)	680 (9.9)	13	16	1100 (16.0)	990 (14.4)	11	13	1400 (20.4)	1260 (18.4)	2000 (29.2)	1800 (26.3)
8	800 (11.7)	680 (9.9)	13	16	1100 (16.0)	990 (14.4)	11	13	1500 (21.9)	1350 (19.7)	2140 (31.2)	1920 (28.0)
10	800 (11.7)	680 (9.9)	13	16	1100 (16.0)	990 (14.4)	11	13	1550 (22.6)	1400 (20.4)	2200 (32.1)	1980 (28.9)
12	800 (11.7)	680 (9.9)	13	16	1100 (16.0)	990 (14.4)	11	13	1700 (24.8)	1530 (22.3)	2420 (35.3)	2170 (31.7)
14	840 (12.3)	720 (10.5)	13	16	1100 (16.0)	990 (14.4)	11	13	1850 (27.0)	1660 (24.2)	2640 (38.5)	2370 (34.6)
15	870 (12.7)	740 (10.8)	13	16	1150 (16.8)	1030 (15.0)	11	13	1980 (28.9)	1780 (26.0)	2800 (40.9)	2520 (36.8)
16	...	...	...	...	1200 (17.5)	1080 (15.8)	11	13	2100 (30.6)	1890 (27.6)	3000 (43.8)	2700 (39.4)
18	...	...	...	...	1300 (19.0)	1170 (17.1)	11	13	2340 (34.1)	2100 (30.6)	3300 (48.1)	2970 (43.3)

<sup>A</sup> Strengths shall be determined by three-edge-bearing method. Strengths of sizes not listed shall be interpolated between tabular sizes and strengths of the nearest listed diameters.

<sup>B</sup> If tile fails to meet absorption requirements, see Section 5.2. Absorption requirements for Extra-Quality Tile also apply to Heavy-Duty and Extra Strength Tile.

rows shall be as shown in Table 3. Where two rows of perforations are used, the rows shall be separated by an arc of  $90 \pm 15^\circ$ . Where four rows of perforations are used, the rows shall be located in the lower half of the tile and shall be symmetrical around the vertical center line. The lowermost rows of perforations shall be separated by an arc of  $90 \pm 10^\circ$ , and the uppermost rows shall be separated by an arc not over  $160^\circ$  measured around the lower part of the tile (Fig. 1). If more than four rows of perforations are used, the spacing of rows between these limits shall be uniform.

## 7. Sampling and Testing

7.1 Tile shall be sampled and tested in accordance with Sections 7 to 18 of Specification C 4, with the following

modification: Substitute for the last sentence of 11.4 of Specification C 4 the following requirement: In testing a tile the two lower rows of perforations shall be set equidistant from the midpoint between the lower bearing strips.

## 8. Basis of Acceptance

8.1 Acceptability of the tile shall be determined by (1) measurements and visual inspection as prescribed in Sections 7 and 9, and (2) compliance with the physical properties as prescribed in Section 5.

8.2 Acceptance of drain tile as satisfactorily meeting one of the two general requirements in 8.1 shall in no way be construed as waiver of the other.

**TABLE 3 Number of Perforations for Perforated Clay Drain Tile**

Tile Size Diameter, in. (mm)	Minimum Number of Rows of Perforations <sup>A</sup>	Minimum Number of Perforations per Row				
		Nominal Lengths of Tile, ft (m)				
		1 (0.30)	1½ (0.45)	2 (0.60)	2½ (0.76)	3 (0.91)
4, 5, 6 (102, 127, 152)	4	3 (0.91)	5 (1.52)	7 (2.13)	9 (2.74)	11 (3.35)
4, 5, 6 (102, 127, 152)	2	5 (1.52)	8 (2.43)	11 (3.35)	13 (3.96)	15 (4.57)
8, 10, 12 (203, 254, 305)	4	3 (0.91)	5 (1.52)	7 (2.13)	9 (2.74)	11 (3.35)
14 to 18 (356 to 457)	6	...	5 (1.52)	7 (2.13)	9 (2.74)	11 (3.35)

<sup>A</sup> See 6.3 for variations in hole sizes.

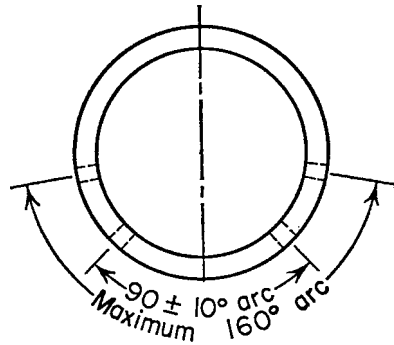


FIG. 1 Spacing of Four Rows of Perforations

## 9. Inspection and Rejection

9.1 All drain tile shall be given a thorough inspection by a competent inspector approved by the purchaser. The tile shall be inspected at a location and time agreed upon between the purchaser and the seller. The purposes of the inspection shall be to: (1) cull and reject imperfect individual tile, and (2) determine whether the remaining tile, by visual inspection, meet the requirements set forth in Section 4 and in 9.2.

9.2 Drain tile in a dry condition shall give a clear ring when held free of ground or tipped on edge and tapped lightly with a hammer which has a head not exceeding 4 oz (113 g) in mass.

9.3 Except as otherwise provided in this specification, the seller may appeal from decisions of the inspector when such

decisions are based on visual inspection alone, in which case the point of issue shall be determined by standard physical tests made in accordance with Sections 9 to 18 of Specification C 4. Costs of such tests made as a result of an appeal shall be paid by the seller if the tests confirm the inspector's decision; otherwise, these costs shall be paid by the purchaser.

9.4 The inspector shall plainly mark all rejected drain tile, which shall be removed promptly by the seller at the expense of the seller.

9.5 No drain tile shall be rejected by the purchaser on the basis of physical tests unless the laboratory test report is made available to the seller.

## SUPPLEMENTARY REQUIREMENTS

These requirements apply *only* to Federal/Military procurement, not domestic sales or transfer.

### S1. Government/Military Procurement

S1.1 *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1.1—In U.S. Federal contracts, the contractor is responsible for inspection.

### S2. Packaging and Marking for U.S. Government Procurement:

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2.1—The inclusion of U. S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this document.

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