



Designation: C 159 – 98

Standard Specification for Vitrified Clay Filter Blocks¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification establishes the criteria for acceptance, prior to installation, of vitrified clay filter block used in trickling filters for the treatment of sewage and industrial wastes.

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.

1.3 The following precautionary caveat pertains only to the test method portions shown in Annex A1-Annex A3. *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 150 Specification for Portland Cement²

C 896 Terminology Relating to Clay Products³

E 4 Practices for Force Verification of Testing Machines⁴

E 6 Terminology Relating to Methods of Mechanical Testing⁴

3. Terminology

3.1 The definitions for clay, fire clay, shale, and surface clay are as defined in Terminology C 896.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *compressive strength*—the pressure, measured in psi (kPa) which causes failure of vitrified clay filter block, with the load being applied to the block in the direction of use.

3.2.2 *filter block*—rectangular, vitrified clay units with interior drainage channels, having apertures that connect to the drainage channels through the upper surface. The apertures are

arranged to form drainage and aeration grilles that pass air into, and liquids from, overlying filtering media. The drainage channels of the filter block provide for the conveyance of the filtered liquid away from the filter bed.

3.2.2.1 *Type I-S and Type I-H filter block*—one-piece units suitable for constructing a single-course trickling filter floor.

3.2.3 *lot*—unless otherwise specified, a lot shall consist of all filter block of each type of the contract or purchase order.

3.2.4 *walls*—Exterior vertical sides of vitrified clay filter block.

3.2.5 *webs*—interior supports separating channels of vitrified clay filter block.

4. Classification

4.1 Filter block are manufactured in the following types:

4.1.1 Type I-S, standard rate and

4.1.2 Type I-H, high rate.

4.2 The purchaser shall specify the type of filter block to be furnished.

5. Ordering Information

5.1 Orders for filter block under this specification shall include the following information:

5.1.1 Quantity,

5.1.2 Type of filter block,

5.1.3 ASTM designation and date of issue,

5.1.4 Required tests or certification, and

5.1.5 Inspection location; factory or point of delivery.

6. Materials and Manufacture

6.1 Filter block shall be formed from fire clay, shale, surface clay, or a combination of these materials.

6.2 Formed filter block shall be fired to a suitable temperature to yield a product that is strong, durable, and serviceable and conforms to this specification.

7. Chemical Requirements

7.1 *Acid Resistance*—Acid-soluble matter in filter block shall not exceed 0.25 % by weight when tested as specified in this specification in any of the following acids: sulfuric (H₂SO₄), hydrochloric (HCl), nitric (HNO₃), or acetic (CH₃COOH). The test shall be performed only when specified.

¹ This specification is under the jurisdiction of ASTM Committee C-4 on Vitrified Clay Pipe and is the direct responsibility of Subcommittee C04.20 on Methods of Test and Specifications

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² *Annual Book of ASTM Standards*, Vol 04.05.

³ *Annual Book of ASTM Standards*, Vol 04.01.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

7.2 The purchaser shall designate the acid or acids to be used in this test.

8. Physical Properties

8.1 *Compressive Strength*—Compressive strength tests shall be performed on full- or half-size block. The average compressive strength of filter block units shall be at least 450 psi (3100 kPa), and no individual unit shall have a compressive strength less than 400 psi (2760 kPa). The compressive strength shall be calculated on the gross area of the block.

8.2 *Absorption*—The average absorption of five filter block, determined by 1-h submersion in boiling water, shall not exceed 6 % by weight.

9. Dimensions and Permissible Variations

9.1 *Aperture*—The smallest dimension of an aperture in Type I-S and I-H filter block shall not exceed 1½ in. (38 mm), and the total aperture area shall be at least 20 % of the top area.

9.2 Drainage Channels:

9.2.1 The drainage channel cross-sectional area shall be defined as the channel area lying below the lowest level of the aperture. Minimum cross-sectional area of drainage channels in filter block shall be as shown in the following table:

Drainage Channel Cross-Sectional Area

Type	Area, min. in. ² /ft (cm ² /m) of width
I-S	20 (425)
I-H	40 (850)

9.2.2 Drainage channels of filter block shall be curved or narrowed at the bottom to maintain velocity in the channels at low flow.

9.2.3 The minimum depth of drainage channels in filter block shall be 2½ in. (64 mm), measured from the lowest level of the aperture.

9.2.4 There shall be at least two parallel drainage channels per foot (0.3 m) of width of Type I-S and I-H filter block.

9.3 *Exterior Walls and Interior Webs*—Thickness of exterior walls in Type I-S and I-H filter block shall be at least ¼ in. (14 mm) and interior webs separating drainage channels shall be at least ½ in. (13 mm).

9.4 Permissible Variations in Dimensions:

9.4.1 Exterior dimensions of filter block shall be the dimensions stated by the manufacturer, ±¼ in./ft (20 mm/m).

9.4.2 The lower bearing surface of filter block shall not vary from a plane by more than ⅜ in./ft (15 mm/m) of the greatest dimension of the block.

10. Workmanship, Finish, and Appearance

10.1 Filter block shall be substantially free of laminations.

10.2 Blisters shall not exceed 2 in. (50 mm) in diameter, and blisters or pimples shall not project more than ⅛ in. (3 mm) above the surface.

10.3 Chips shall not exceed 2 in. (50 mm) in length, 1 in. (25 mm) in width, and a depth of ⅜ in. (5 mm).

10.4 Open cracks shall be no longer than 1½ in. (38 mm) and surface cracks no longer than 3 in. (75 mm). Open cracks shall not extend through the upper surface from the end of the filter block to an aperture opening, nor between aperture openings.

11. Sampling

11.1 *Selection of Test Specimens*—Full- or half-size filter block shall be selected by the purchaser or his representative at points he designates when placing the order. Specimens shall meet the dimensions, workmanship, finish, and appearance requirements of this specification.

11.2 *Number of Specimens*—The number of specimens to be tested shall be at least five full-size or half-size filter block selected from each lot, except the acid resistance tests shall be tested on one specimen from each lot. Additional specimens may be tested at the discretion of the purchaser.

11.3 *Identification*—Each specimen shall be marked so that it may be identified at any time. Filter block specimen markings shall not cover more than 5 % of the superficial area of the specimen.

12. Retesting

12.1 If test specimens from a lot fail to meet compressive strength, absorption, or acid resistance requirements, the manufacturer or seller may sort the shipment into two lots. New samples shall be selected by the purchaser from the lot to be retained. If the set of test specimens from the retained lot fails to meet these requirements, the retained lot shall also be rejected.

13. Test Methods

13.1 Physical and chemical tests shall be conducted in accordance with the procedures described in Annex A1-Annex A3.

14. Inspection

14.1 Filter block shall be subject to inspection by the purchaser or the purchaser's representative. Inspection shall be made at the factory or promptly at the point and time of delivery. The purpose of this inspection is to determine whether the filter block meet the dimension, workmanship, appearance, and marking requirements of this specification.

14.2 Filter block that do not meet the dimensions, workmanship, appearance, and marking specifications shall be rejected and replaced by the manufacturer or seller with filter blocks that meet the specifications.

14.3 If the purchaser desires compressive strength, absorption, and acid resistance tests, the purchaser shall select filter block for testing in accordance with the sampling procedures of this specification. Ten days shall be allowed after sampling for completion of testing.

14.4 The cost of initial inspection and testing shall be borne by the purchaser. The cost of retesting because of failure of the filter block to pass the initial test shall be borne by the manufacturer.

15. Certification

15.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser stating that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. A report of the test results shall be furnished when required.