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Standard Guide for Use of Drainage System Media with Waterproofing Systems¹

This standard is issued under the fixed designation D7492/D7492M; 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.

1. Scope

1.1 This guide makes recommendations for the selection and application of prefabricated drainage media used in conjunction with waterproofing systems on horizontal and vertical surfaces. Drainage media considered include rigid and semi-rigid insulation boards and rigid materials including plastics. The scope of this guide does not cover other drainage media including gravel and filter fabric systems that can be constructed. The scope of this guide does not cover drainage materials or drainage system designs used for vegetative roof systems. Vegetative roof systems require specialized designs.

1.2 The committee with jurisdiction over this standard is not aware of any other comparable standards published by other organizations.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 This standard may involve hazardous materials, operations and equipment. *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:²

- C165 Test Method for Measuring Compressive Properties of Thermal Insulations
- C898 Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Separate Wearing Course

¹ This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.22 on Waterproofing and Dampproofing Systems.

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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.

- C981 Guide for Design of Built-Up Bituminous Membrane Waterproofing Systems for Building Decks
- C1471 Guide for the Use of High Solids Content Cold Liquid-Applied Elastomeric Waterproofing Membrane on Vertical Surfaces
- D896 Practice for Resistance of Adhesive Bonds to Chemical Reagents
- D1079 Terminology Relating to Roofing and Waterproofing
- D2434 Test Method for Permeability of Granular Soils (Constant Head) (Withdrawn 2015)³
- D3273 Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- D3385 Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer
- D4511 Test Method for Hydraulic Conductivity of Essentially Saturated Peat
- D4630 Test Method for Determining Transmissivity and Storage Coefficient of Low-Permeability Rocks by In Situ Measurements Using the Constant Head Injection Test
- D4716 Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- D5898 Guide for Details for Adhered Sheet Waterproofing
- D6622 Guide for Application of Fully Adhered Hot-Applied Reinforced Waterproofing Systems
- E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

3. Terminology

3.1 Refer to Terminology D1079 for definitions of terms used in this guide.

4. Summary of Practice

4.1 This guide describes a method to estimate the amount of water a drainage system may need to carry. The guide also offers descriptions of the various drainage systems in existence today along with suggestions on how different building situations will require different performance characteristics from the drainage medium chosen. Items to be aware of during the

³ The last approved version of this historical standard is referenced on www.astm.org.

installation of drainage systems is also covered along with illustrations of typical drainage systems.

5. Significance and Use

5.1 This guide provides information and guidelines for the selection and installation of drainage systems media that are in conjunction with waterproofing systems. This guide is intended to be used in conjunction with Guides C898, C981, C1471, D5898, and D6622 and to provide guidelines for the total waterproofing and drainage system.

6. General

6.1 In selecting a drainage medium for use with waterproofing, consideration should be given to the design of the waterproofing system. In particular orientation of the system, attachment recommendations, connections to interior and exterior drainage systems and external loads applied to the system. Additional considerations include the materials and construction over the drainage medium, installation recommendations, durability, and penetrations and joints. (See Figs. 1-3.) In all designs, the potential slip planes should be considered.

6.2 *Compatibility*—It is essential that all components and contiguous elements of the waterproofing system are compatible and that the design of the system's waterproofing and drainage is coordinated to form an integrated waterproofing system.

6.3 *Basic Components*—The various types of drainage media available are outlined in Section 12 of this guide and all consist of one or more of the following basic components. The basic components of typical drainage medium are a mounting surface that is placed against the waterproofing membrane to prevent embedment of the media, a porous core that provides a drainage path, and a filter fabric bonded over the porous core to prevent clogging of the drainage paths. Fibrous and foam drainage media are homogeneous materials that are sufficiently dense that they can be placed directly against the waterproofing membrane. Other foam boards merely provide periodic grooves creating paths to drain water away from the water-proofed surface. However fibrous and foam media may not function properly in horizontal or nearly horizontal (<30°) orientations. The filter surface, whether fabric or the base

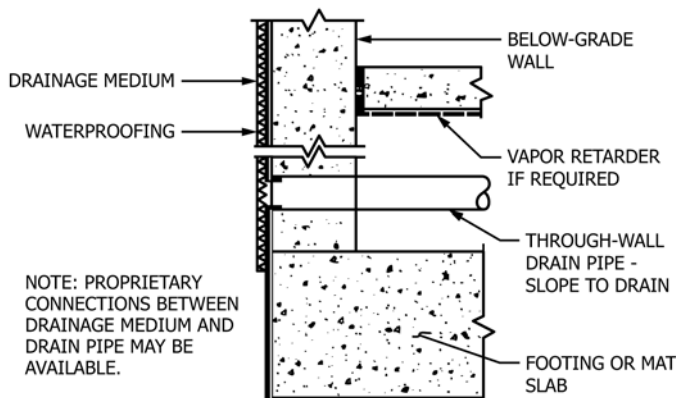


FIG. 1 Drainage at Lot Line Below-Grade Wall

material, must have adequate porosity so as not to restrict drainage through the face of the media. In some installations, particularly those with a high percentage of silt in the backfill, the filter porosity should be selected relative to the soil particle size distribution to ensure the filter surface will not become clogged. Where appropriate, a protection board should be installed between the waterproofing and drainage media to reduce embedment of drainage media into the waterproofing.

6.4 The drainage media selection should include a consideration of the forces that will be placed on it, such as backfill pressure, gravity loads and shear loads both initially and over the expected useful life of the assembly.

6.5 The construction of drainage media should be considered relative to the strength density (carrying capacity) and of the waterproofing membrane. The bearing surface of drainage media must place no sharp edges against the waterproofing membrane, which could puncture, abrade the membrane or imprint itself in the membrane. The filter fabric and its bond to the drainage medium core should resist impact, compressive, and shear loads imposed by backfilling and compaction, temporary and permanent constructions loads.

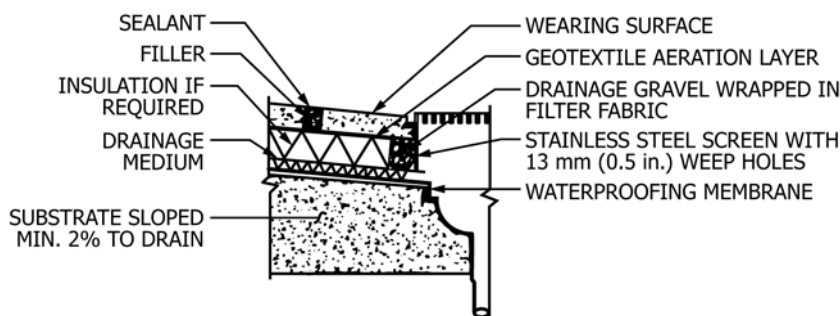
6.6 The drainage media should always be placed next to the waterproofing. This location minimizes the hydrostatic head on top of the waterproofing. If insulation is required the insulation shall be specified to handle the environment that is present outside the drainage media and waterproofing membrane. If the insulation is porous, the drainage media must allow the porous insulation to drain any water accumulated during construction or during its service on the wall into either the drainage media or the footing drain tile system. A non-porous insulation is any insulation with closed cells that prevent water from flowing in or out, for example extruded polystyrene foam or polystyrene foam bead boards. A porous insulation is any insulation that has open channels that easily allow water to enter and leave the insulation such as rigid fiberglass boards with a perm rating of 4.6 Darcy (k, mm/s) or more (see X1.1.3).

7. Drainage Capacity

7.1 *General*—The drainage capacity is the volume of water that passes through drainage media in a specified direction under a known hydraulic gradient. The two major drainage capacities of interest are the in-plane and through-the-face drainage capacities. The orientation of the media and any slope of the substrate will have a major effect on the drainage capacity.

7.1.1 *Through-the-Face Drainage*—Through-the-face drainage is the flow or seepage of water perpendicular to the longitudinal axis of the drainage media. When media are installed in a horizontal orientation, through-the-face drainage may occur due to failure (that is, cracks) in the material(s) placed atop the media or due to the normal permeability of the material(s) such as soil or open joint pavers. When media are installed in a vertical orientation, though- the-face drainage capacity should be several times greater than the expected drainage flow to the media.

7.1.2 *In-plane Drainage*—In-plane drainage occurs in drainage media installed in horizontal orientation.



NOTE 1—Or slotted drains with 1/2-in. slots.

FIG. 2 Drain in Plaza with Solid Surfacing

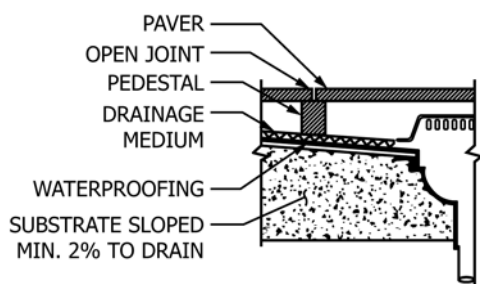


FIG. 3 Drain in Plaza with Paver and Pedestal Surfacing

plaza decks, parking decks, and below-grade passageways. In these orientations, the hydraulic gradient will be relatively low. Therefore, the drainage paths or pores in the media should be relatively large to ensure the media does not hold water due to surface tension and capillary forces.

7.1.2.1 To determine the drainage capacity needed the designer has to be familiar with the climate, terrain, adjacent buildings and structures that could redirect rain water or run off onto the area that has to be drained, if there is soil overburden on the drainage media, etc. **Appendix X1** contains methods that could be used to calculate the capacity needed for the drainage system. In no way does **Appendix X1** contain all the different methods for calculating the capacity needed by a drainage system and undoubtedly local methods exist which work quite well in their particular area

7.1.3 *Resistance to Clogging*—Drainage media must resist clogging or silting of the media filter or other openings. The selection of the media should be made only after the particle-size distribution of the material(s) placed adjacent to the filter media is known. If the filter opening size is large relative to the majority of adjacent particles, the adjacent particles will pass through the filter media and may, in time, clog the media. A correctly selected filter media should permit some fine particles to pass through the face of the media but retain a layer of larger particles at its surface until a filter cake is established. The fine particles within the media will eventually be flushed from the media. As for determining which fabric should be used, there are a number of resources that may be used. Several geotextile manufacturers have brochures and spec data sheets for different types of fabrics which contain information on how to choose the right geotextile for the given situation. Another fabric may be needed to handle particular soils or situations with fine laden overburden. Recent civil engineering handbooks (see **Note 1**)

have sections devoted to the selection of geotextiles for filtration and water drainage among other topics.

7.1.4 *Long-term Performance*—The materials used for drainage media must be capable of surviving the environment in which they are placed for at least the life of the waterproofing system. The physical properties of the media that relate to drainage capacity, such as compressive strength, shear strength, resistance to biological deterioration, and freeze-thaw resistance must be sustained throughout the service life of the media.

7.1.5 Another performance issue arises when installing drainage media on “vegetative roof system” or garden patio situations. Consideration must be given on how the drainage media will either stop root penetration or how the roots from large plants and small trees will affect the performance of the drainage media. How this is accomplished along with other design criteria necessary for a “vegetative roof system” is beyond the scope of this guide. See **Note 1**.

NOTE 1—The footnoted books on civil engineering^{4,5} and other relevant books may be found on web sites such as Amazon.com and Barnesand-noble.com.

7.1.6 *Interfaces To Other Drainage Systems*—The selection of drainage media must take into consideration the joining of the installed media to other adjacent drainage systems that can be located inside (lagging walls, **Fig. 1**) and outside of a building or foundation. For a horizontal orientation, consideration must be given to adequately connecting the drainage media to vertically oriented drainage media. For a vertical application, consideration must be given to the connection with the drainage system at the base of the media, usually a perimeter drain system.

8. Physical Properties

8.1 *General*—Drainage media used in conjunction with a liquid applied waterproofing system should have certain physical properties to provide some level of confidence that the drainage media will perform as stated throughout its required service life. Properties that are considered in this guide include drainage capacity (discussed in Section 7), compressive strength, flexural strength, puncture resistance edge strength

⁴ *Civil Engineering Handbook*, 2nd edition, Liew, R. J. V. and Chen, W. F. editors, August 2002.

⁵ *Standard Handbook for Civil Engineers*, Richards, J. T., Merritt, F. S., and Loftin, M. K., editors, Dec 2003.