Designation: D8014 – 17

Standard Guide for Selection of Membranes Used in Vegetative Roofing Systems[1]

This standard is issued under the fixed designation D8014; 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 The purpose of this guide is to provide guidance in the selection of a suitable waterproofing membrane within a vegetative roof system. The guide offers various options for reviewing the membrane installation during and upon completion of the installation and prior to the vegetative components being installed. This guide applies to membranes that do or do not require UV protection. For the purpose of this guide, the supporting structure and roof deck are assumed to be mechanically and structurally sound and will accept the weight of the vegetative roof system including the membrane, insulation, and other roofing/waterproofing components including all components related to the vegetative layers as well as the required design loads. Slope to drain at the membrane level is preferred and should be included where possible. Providing a replacement or a re-cover vegetative roofing system on an existing building may require that the support structure be reinforced so that it can safely support the additional weight of the vegetative roof system and also provide the minimum live load capacity required by the building code.

1.2 Design criteria associated with the vegetative portions of the system are beyond the scope of this guide. Please refer to Guide E2777.

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 and health 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]

D1079 Terminology Relating to Roofing and Waterproofing

D5957 Guide for Flood Testing Horizontal Waterproofing Installations

D7877 Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes

E2777 Guide for Vegetative (Green) Roof Systems

2.2 *ANSI/SPRI Standards:*[3]

ANSI/SPRI VR-1 Procedure for Investigating Resistance to Root Penetration on Vegetative Roofs

2.3 *Other Standards and Documents:*

FLL Guidelines for the Planning, Construction and Maintenance of Green Roofing – Green Roofing Guideline Section 6.3 Protection Against Damage to the Waterproofing / Root-resistant Membranes FLL Procedure for Investigating Resistance to Root Penetration of Roof Membranes and Protective Layers for Green Roofing[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, see Terminology D1079.

4. Significance and Use

4.1 This guide provides the general information, procedures, and guidelines for the selection of the waterproofing membrane to create a waterproofing system for a Vegetative (Green) roof.

4.2 This guide is not all inclusive; this guide is intended to supplement detailed instructions from manufacturers, ASTM Standards, and building code requirements.

5. Roof Design Classifications

5.1 *Types of Constructions or Applications:*

[1] This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.24 on Sustainability.

Current edition approved July 15, 2017. Published August 2017. DOI: 10.1520/D8014-17.

[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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. (FLL), Friedensplatz 4, 53111 Bonn, Germany, www.fll.de.

5.1.1 *New*—A vegetative roof can be integrated with the other building elements during construction. All new components are used to construct the roofing/waterproofing system. Performance and service requirements of the vegetated roof are addressed in the building design.

5.1.1.1 *Replacement (Total)*—Removal of existing roof system and all roof system components (roof membrane, cover board, insulation, vapor retarder, support panels, etc.) down to the supporting deck and replacing with new vegetative roof system and vegetative roof system components. Total replacement allows for an evaluation of the roof deck and structure to determine if additional repairs, structural enhancements, or replacement are needed to accommodate the new vegetative roof system.

5.1.1.2 *Replacement (Partial)*—Removal of existing roof membrane system. Existing roof system components below the membrane, such as cover boards, insulation, vapor barrier, etc., may be left in place if determined to meet the requirements for the newly installed system. A thorough assessment of those components left in place should be carried out to determine their condition. Particular attention should be given to their securement and wind uplift resistance. All damaged, moisture contaminated, and deteriorated components should be removed and replaced with new components.

5.1.2 *Re-cover*—A new waterproofing membrane is installed over the existing membrane system. A thorough evaluation of the existing roof system, decking and structure should be performed to determine that it is suitable for the new vegetative roof system. A series of test cuts, together with non-destructive moisture methods such as infrared thermography and nuclear moisture scanning, can be used to examine roofs for wet areas. All damaged, moisture contaminated and deteriorated components should be removed and replaced with new.

6. Vegetative Roofing Membrane and System Attributes

6.1 Vegetative waterproofing membranes have different requirements than membranes intended to be exposed in-service due to the fact the membrane will be buried under the components of the vegetative layers, subject to a moist, microbial environment, and not readily accessible for inspection and maintenance. The service life of the waterproofing membrane may be influenced by the type of material, the thickness of the membrane, and the method of attachment. Refer to the flow chart in Fig. 1 for assistance in choosing the waterproofing membrane.

6.2 *Methods of Membrane Securement for Vegetative Roofs*—See Table 1.

6.3 Vegetative waterproofing membranes will more likely have more water retained above the membrane, and be more often in contact with damp materials, than roofs with exposed membranes. Waterproofing membranes used in vegetative roofing systems should be capable of withstanding hydrostatic pressure as well as resisting absorption of water, water vapor diffusion, deterioration from contact with damp materials or moisture for long periods of time.

NOTE 1—If a loose laid waterproofing membrane utilizes an integrally bonded reactive layer to the underside of the waterproofing membrane, the reactive material layer may be excluded from this absorption property.

6.4 The vegetative waterproofing membrane should be protected from root penetration at any point including into membrane laps and seams. Some waterproofing membranes systems have the ability to block root penetration, while other waterproofing membranes will require an additional sheet to provide protection from root penetration. Any waterproofing membrane employed as a root barrier should comply with FLL or ANSI/SPRI VR-1 requirements for acceptable root barriers.

6.5 Vegetative waterproofing membranes may be exposed to various chemicals such as fertilizers, pesticides, and herbicides and should be resistant to these chemicals. The waterproofing membrane should also be resistant to mold, fungal, and biological growth.

6.6 Waterproofing membranes that may be exposed to the elements (not covered with vegetation or ballast) should be rated for the required wind and fire exposures and be formulated for exposure to the elements.

7. Quality Assurance

7.1 Visual and physical inspections of the waterproofing membrane should be scheduled during installation as well as prior to the installation of the vegetative components. The inspections may be conducted by one or all of the following; a trained monitor, the designer or the roof membrane supplier. Verify that the waterproofing membrane is installed in accordance with the written specifications, details, and submittals.

7.2 Along with the visual and physical inspections additional methods of leak detection are recommended before covering the membrane, such as flood testing or electronic leak detection. Some types of membranes require adding metal components or metallic primer coating in order to work with ELD.

7.2.1 *Flood Tests*—Flood testing should be carried out in conformance with Guide D5957. Flood testing is not intended for steep slope vegetative roofs.

7.2.2 *Electronic Leak Detection*—Electronic leak detection testing should be carried out in conformance with Guide D7877.

8. Keywords

8.1 root resistance; UV resistance; vegetative roofing; waterproofing membrane

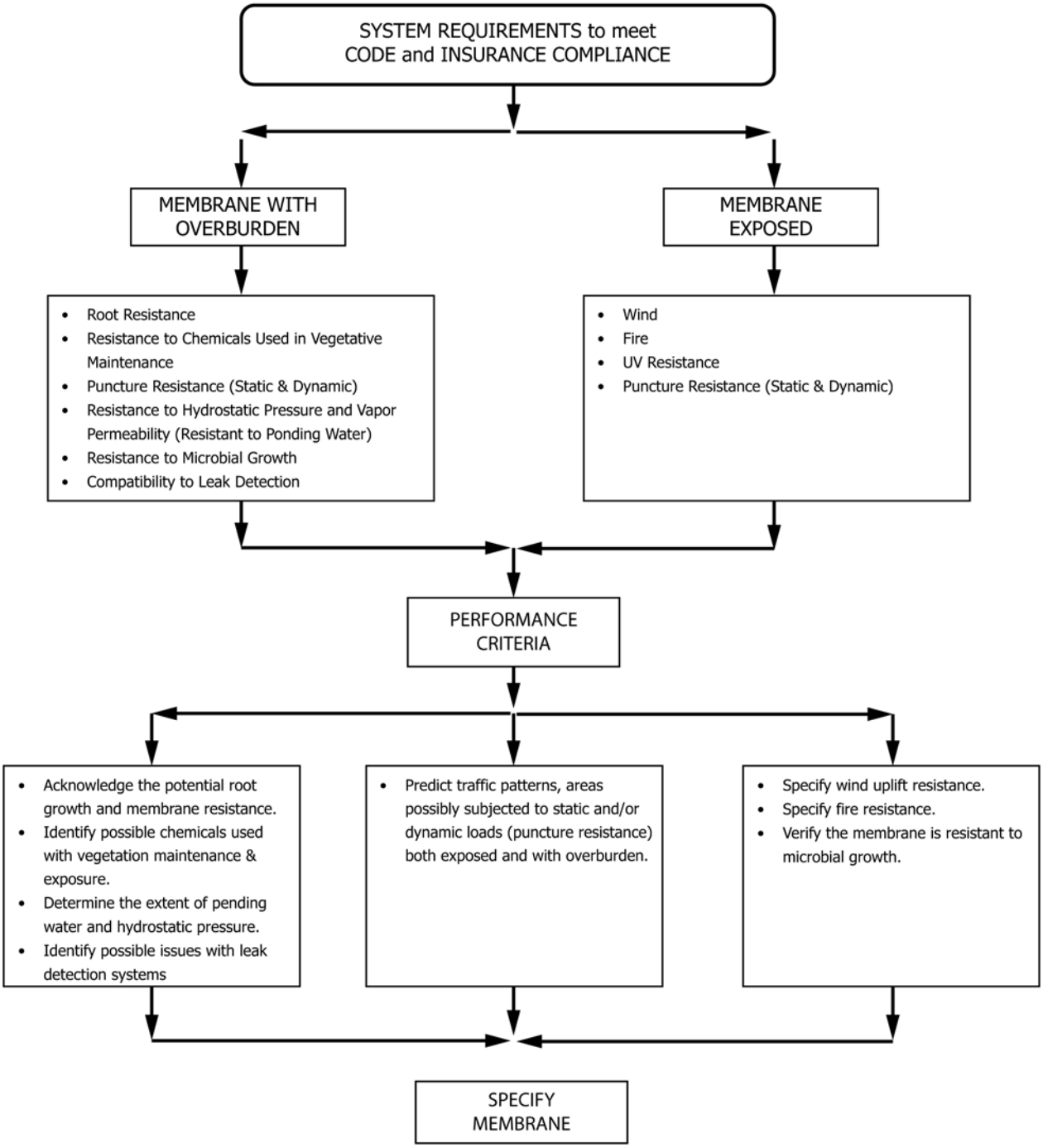

FIG. 1 Membrane Selection Flow Chart

TABLE 1 Methods of Membrane Securement for Vegetative Roofs[A, B]

Membrane Configuration	Method of Attachment
Adhered	Uses adhesives, hot or cold applied. Includes self-adhesive roof membranes.
Loose Laid	The weight of the vegetative system, aggregate ballast, and or pavers provides the wind uplift resistance.
Protected Membrane Assembly	The roof insulation is placed above the waterproofing membrane which may be adhered or loosely laid onto the deck. The vegetative roof components (drainage layer, growing medium, plantings, etc.) are placed on top of the insulation. The weight of the vegetative system, aggregate ballast, and or pavers provides the wind uplift resistance and prevents floatation and displacement of the insulation.
Mechanically Attached	The waterproofing membrane is attached to the deck with discrete fasteners, battens, or bars, or combinations thereof.

[A]It is generally considered best practice to have the waterproofing membrane adhered to the roof deck to limit water migration should there be a leak and it protects against membrane loss if the plants die and the soil blows away. With a loose laid or mechanically attached membrane, it is suggested to use a containment mechanism under the waterproofing membrane to isolate or prevent lateral water migration. The containment mechanism can be a material grid system or a secondary reactive layer integrally bonded to the membrane to stop lateral water migration.
[B]The type of membrane securement and UV resistance may be considered during the design stage if the vegetative system may be removed during the service life of the membrane.