



Designation: D8231 – 24a

Standard Practice for the Use of a Low-Voltage Electronic Scanning System for Detecting and Locating Breaches in Roofing and Waterproofing Membranes¹

This standard is issued under the fixed designation D8231; 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 practice describes standard procedures for using an electronic scanning system to locate membrane breaches on both horizontal and vertical surfaces to locate potential leaks in exposed roofing and waterproofing membranes.

1.2 This practice addresses the need for a detailed technical description of a scanning method and procedures that are used to test and verify the integrity of membranes.

1.3 This practice is not intended to replace visual or other methods of inspection. It is to be used in conjunction with other methods of roof inspection when specified.

1.4 This practice requires that the detection and location equipment, procedures, and survey parameters used are calibrated to meet established minimum leak detection sensitivity. The detection sensitivity calibration must be verified on a regular basis using the manufacturer's procedures to ensure maximum confidence in the results.

1.5 Scanning surveys can be used on membranes installed on roofs, plaza decks, pools, water features, covered reservoirs, and other roofing and waterproofing applications.

1.6 This practice is applicable for membranes made of electrically insulating materials and is used on certain moderately conductive membranes (see Test Method [D4496](#)).

1.7 This practice provides a description of the scanning method and equipment for locating membrane breaches using electric conductance and is intended to be used in conjunction with the manufacturer's instructions for the proper operation and use of the equipment.

1.8 *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.

1.9 *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](#)
[D4496 Test Method for D-C Resistance or Conductance of Moderately Conductive Materials](#)

[D7877 Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes](#)

2.2 NFPA Standards:³

[NFPA 70 National Electrical Code](#)

3. Terminology

3.1 For definitions of terms, see Terminology [D1079](#) and the terminology section of Guide [D7877](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *membrane scanning, n*—a method for locating membrane breaches by passing a leak detection sensor over the entire surface of the membrane being tested.

3.2.2 *moderately conductive, adj*—materials that exhibit a surface resistivity in the range of 10^3 to 10^7 ohms-per-square.

3.2.3 *ohms-per-square, n*—the unit of measurement when measuring the resistance of a thin film of a material using the four point probe technique. It is equal to the resistance between two electrodes on opposite sides of a theoretical square. The size of the square is unimportant.

¹ This practice 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 www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

NOTE 1—Waterproofing membranes tested by electrical conductance methods may be horizontal, sloped, or vertical.

NOTE 2—Examples of waterproofing membranes in this practice include but are not limited to: below-grade waterproofing membranes, above-grade waterproofing membranes, waterproofing membranes covered by wearing courses, vegetative roof membranes, planter waterproofing membranes, and roof membranes.

4. Significance and Use

4.1 The failure to correct membrane breaches during and after its installation can cause premature failure of the membrane and damage to the structure. Root causes may include design deficiencies, faulty application of the membrane system, product failure, material incompatibility, and damage by other trades. Roof designs incorporating a roofing or waterproofing membrane under overburden must be tested for breaches before overburden is installed.

4.2 This practice describes a low-voltage (less than 50 V as defined by NFPA 70), dual sweep scanning method using electronic leak detection to locate breaches in roofing and waterproofing membranes. The method described includes testing procedures designed to provide a part of the quality assurance of roofing and waterproofing membranes.

4.3 The methods described in this practice may also be used for forensic testing of existing roofing and waterproofing membranes; however, specific limitations apply that are described later.

5. Summary of Membrane Breach Detection Using Electronic Scanning

5.1 The principle of the electronic breach detection method, as detailed in Guide D7877, is the establishment of an electrical potential between the electrically insulating or moderately conductive waterproofing membrane and its underlying conductive substrate.

5.2 For the low-voltage method described in this practice, a controlled covering of water on the surface forms the conductive path horizontally across the membrane to any membrane breach. At a breach location, an electrical path is formed through the water to the conductive substrate below. A dual

sweep scanning platform with an integrated sensitive receiver detects the leakage current through a membrane breach to the substrate.⁴

5.3 The substrate material directly below the membrane must be sufficiently conductive (approximately 10^4 ohms-per-square or less as determined using Test Method D4496) for the test method described in this practice to detect membrane breaches reliably. In most instances, a concrete substrate is sufficiently conductive to successfully detect membrane breaches using this method. In membrane assemblies, where the substrate is nonconductive, a conductive material can be placed directly under the membrane to facilitate testing.

5.4 This practice is applicable to moderately conductive membranes characterized by surface conductivity equal to or greater than 10^7 ohms-per-square as determined using Test Method D4496.

6. Horizontal Membrane Scanning Platform Basic Principles of Operation

6.1 The principle of the scanning platform method is to establish an electric potential between the scanning platform and a conductive substrate under a roofing or waterproofing membrane and track any leakage current passing through a breach in the membrane. This is accomplished by wetting the surface of the membrane to be tested, generating a voltage with respect to the substrate, and then locating areas where electrical current flows from the scanning platform through membrane breaches to the substrate.

6.2 The basic circuit and application of a dual sweep scanning platform is shown in Fig. 1. The scanning platform is constructed with two sets of metal sweeps which make continuous electrical contact with the membrane surface. The

⁴ The horizontal scanning platform and the vertical unit with roller are covered by patents held by Detec Systems LLC (US Patent 7,847,560 and 10,345,188, respectively). Interested parties are invited to submit information regarding the identification of an alternative(s) to these patented items to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

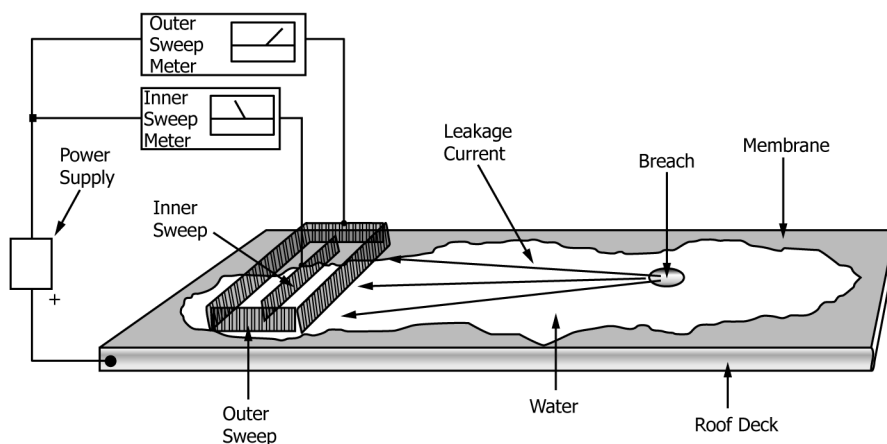


FIG. 1 Basic Circuit and Application of the Membrane Scanning Platform