INTERNATIONAL

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Standard Practice for Electrical Leak Location Using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive-Backed Geomembrane Spark Test)[1]

This standard is issued under the fixed designation D7240; 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 is a performance-based standard for an electrical method for locating leaks in exposed conductive-backed geomembranes. For clarity, this practice uses the term "leak" to mean holes, punctures, tears, knife cuts, seam defects, cracks, and similar breaches in an installed geomembrane (as defined in 3.2.7).

1.2 This practice can be used for conductive-backed geomembranes installed in basins, ponds, tanks, ore and waste pads, landfill cells, landfill caps, canals, and other containment facilities. It is applicable for conductive-backed geomembranes made of materials such as polyethylene, polypropylene, polyvinyl chloride, chlorosulfonated polyethylene, bituminous geomembrane, and any other electrically insulating materials. This practice is best applicable for locating conductive-backed geomembrane leaks where the proper preparations have been made during the construction of the facility.

1.3 For electrical leak location of conductive-backed geomembranes using methods in lieu of or in addition to the spark testing method, the installation must be electrically isolated (as defined in 3.2.5).

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 The spark test may produce an electrical spark and therefore should only be used where an electrical spark would not create a hazard. *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.*

1.6 *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]

D4439 Terminology for Geosynthetics

D5641/D5641M Practice for Geomembrane Seam Evaluation by Vacuum Chamber

D5820 Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes

D6747 Guide for Selection of Techniques for Electrical Leak Location of Leaks in Geomembranes

3. Terminology

3.1 *Definitions:*

3.1.1 For general definitions used in this practice, refer to Terminology D4439.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *conductive-backed geomembrane, n*—a specialty geomembrane manufactured using coextrusion technology, featuring an insulating layer in intimate contact with a conductive layer.

3.2.2 *coupling pad, n*—an electrically conductive pad placed on top of the geomembrane and connected to the spark testing apparatus used to induce electrical potential across the conductive-backed geomembrane.

3.2.3 *current, n*—the flow of electricity or the flow of electric charge.

3.2.4 *electrical leak location, n*—a method which uses electrical current or electrical potential to locate leaks in a geomembrane.

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.10 on Geomembranes.

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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.

3.2.5 *electrically isolated conductive-backed geomembrane installation, n*—an installation of conductive-backed geomembrane that achieves a continuously conductive surface on the bottom layer, while electrically isolating the bottom conductive layer from the top insulating layer of the entire geomembrane installation.

3.2.6 *false positive, n*—an alarm or spark, or both, generated by the spark testing equipment on a feature that is not an actual breach in the geomembrane.

3.2.7 *leak, n*—for the purposes of this document, a leak is any unintended opening, perforation, breach, slit, tear, puncture, crack, or seam breach. Significant amounts of liquids or solids may or may not flow through a leak. Scratches, gouges, dents, or other aberrations that do not completely penetrate the geomembrane are not considered to be leaks. Types of leaks detected during surveys include but are not limited to: burns, circular holes, linear cuts, seam defects, tears, punctures, and material defects.

3.2.8 *wand, n*—for the purposes of this document, any rod that has a conductive element that is attached to a power source to initiate the spark test.

4. Significance and Use

4.1 Geomembranes are used as barriers to prevent liquids from leaking from landfills, ponds, and other containments. For this purpose, it is desirable that the geomembrane have as little leakage as practical.

4.2 The liquids may contain contaminants which, if released, can cause damage to the environment. Leaking liquids can erode the subgrade, causing further damage. Leakage can result in product loss or otherwise prevent the installation from performing its intended containment purpose.

4.3 Geomembranes are often assembled in the field, either by unrolling and welding panels of the geomembrane material together in the field, unfolding flexible geomembranes in the field, or a combination of both.

4.4 Geomembrane leaks can be caused by poor quality of the subgrade, poor quality of the material placed on the geomembrane, accidents, poor workmanship, manufacturing defects, and carelessness.

4.5 Electrical leak location methods are an effective and proven quality assurance measure to detect and locate leaks.

5. Principles and Context of Exposed Geomembrane Electrical Leak Location Methods

5.1 *Principles of the Electrical Leak Location Methods for Exposed Geomembranes:*

5.1.1 The principle of the electrical leak location methods is to place a voltage across a geomembrane and then locate areas where electrical current flows through leaks in the geomembrane.

5.1.2 The spark testing method is only applicable to conductive-backed geomembranes.

5.1.3 Typical installations of conductive-backed geomembranes can be spark tested to within about 100 mm of the seam edge. The seams are then tested with the appropriate seam testing method such as Practice D5641/D5641M or D5820.

5.1.4 In electrically isolated conductive-backed geomembrane installations, it may also be possible to spark test the seams.

5.1.5 Electrical leak location methods in addition to the spark testing method may be used on electrically isolated conductive-backed geomembrane installations. Available methods for exposed and covered geomembranes are detailed in Guide D6747.

6. Spark Testing Method

6.1 A summary of the method is presented in Table 1.

6.2 *Principles of the Spark Testing Method:*

6.2.1 The principle of this electrical leak location method is that the nonconductive (insulating) layer(s) of the geomembrane acts as a dielectric in a capacitor, which provides a low impedance through the geomembrane. The capacitor formed by the conductive pad, the geomembrane, and the conductive layer provides capacitive coupling between one output of a high-voltage power supply to the underlying conductive layer. The area is then swept with a test wand to locate points where the capacitor discharges through a leak. Once the system senses the discharge current, it is converted into an audible alarm.

6.2.2 Fig. 1 shows a diagram of the coupling pad, power supply, and test wand for the electrical leak location method of

TABLE 1 Summary of Spark Testing Method

Geomembranes	Bituminous, CSPE, CPE, EIA, fPP, HDPE, LLDPE, LDPE, PVC, VLDPE	X	not applicable
	Conductive-backed geomembrane	✓	required
	EPDM	X	not applicable
Seams	All types: welded, tape, adhesive, glued, and other		See footnote[A]
Junctions	At synthetic pipes and accessories	✓	applicable: project specific
	At grounded conducting structures	X	not applicable
Survey	During construction phase (installation of GM)	✓	applicable
	Pre-service testing (exposed)	✓	applicable
	Slopes	✓	applicable: project specific
	Insufficiently conductive subgrade	✓	applicable
	During the service life (if exposed)	✓	must be generally clean and dry
Climate	Sunny, temperate, warm	✓	applicable
	Rainy weather	X	not applicable
	Frozen conditions	✓	applicable
Leaks detected	Discrimination between multiple leaks	✓	applicable

[A] Can test to within 4 in. (100 mm) of seams in typical installations. It may be possible to test seams directly on electrically isolated conductive-backed geomembrane installations.