Designation: ~~D7240 – 06 (Reapproved 2011)~~ D7240 – 18

Standard Practice for Electrical Leak Location ~~using~~Using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique ~~(Conductive~~(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 ~~standard~~practice is a performance-based ~~practice for using the spark test to electrically locate~~ standard for an electrical method for locating leaks in exposed ~~geomembranes with an insulating layer that are in intimate contact with a conductive layer.~~ conductive-backed geomembranes. For clarity, this ~~document~~practice uses the term ~~'leak'~~"leak" to mean holes, punctures, tears, ~~cuts, cracks~~ knife cuts, seam defects, cracks, and similar breaches ~~over the partial or entire area of~~ in an installed geomembrane (as defined in ~~3.2.3~~3.2.7).

1.2 This ~~test method~~ practice can be used ~~on exposed~~for conductive-backed geomembranes installed in basins, ponds, tanks, ore and waste pads, landfill cells, landfill caps, canals, and other containment facilities. ~~This standard~~ It is applicable for ~~geomembranes in direct and intimate contact with a conductive surface or with a conductive layer integrally included.~~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 ~~SAFETY WARNING:~~For ~~The electrical methods used for geomembrane leak location use high voltage, low current power supplies, resulting in the potential for electrical shock. The electrical methods used for geomembrane leak location should be attempted by only qualified and experienced personnel. Appropriate safety measures must be taken to protect the leak~~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~~location operators as well as other people at the site.~~).

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 ~~and liability~~ concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and ~~health~~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

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

Current edition approved ~~June 1, 2011~~Feb. 1, 2018. Published ~~July 2011~~February 2018. Originally published in 2006. Last previous edition approved ~~2006~~2011 as ~~D7240~~D7240 – 06 (2011).~~–06.~~. DOI: ~~10.1520/D7240-06R11.~~10.1520/D7240-18.

[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. Terminology

3.1 Definition of terms applying to this test method appear in Terminology D4439.

3.1 *Definitions:*

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

3.2 *Definitions: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 detect and locate leaks. locate leaks in a geomembrane.

3.2.5 *geomembrane, electrically isolated conductive-backed geomembrane installation, n*—an essentially impermeable membrane used with foundation, soil, rock, earth or any other geotechnical engineering related material as an integral part of a man made project, structure, or system. 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*—Forfor the purposes of this document, a leak is any unintended opening, perforation, breach, slit, tear, puncture or crack. 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.

Leaks detected during surveys have been grouped into three categories:

• Holes – round shaped voids with downward or upward protruding rims

• Tears – linear or circular voids with irregular edge borders

• Linear cuts – linear voids with neat close edges

3.2.4 *intimate contact, n*—for the purposes of this document, intimate contact is when a conductive layer is in direct contact with the insulating geomembrane, and there are no gaps between the two layers to prohibit the flow of current.

3.2.5 *leak detection sensitivity, n*—The smallest size leak that the leak location equipment and survey methodology are capable of detecting under a given set of conditions. The leak detection sensitivity specification is usually stated as a diameter of the smallest leak that can be reliably detected.

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

4. Summary of Practice

4.1 The principle of this electrical leak location method is to use a high voltage pulsed power supply to charge a capacitor formed by the underlying conductive layer, the non-conductive layer of the geomembrane and a coupling pad. 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.

4.2 *General Principles*

4.2.1 Fig. 1 shows a wiring diagram of the coupling pad, power supply and test wand for the electrical leak location method of a geomembrane with a lower conductive layer. Once all necessary connections are made, the pad is placed on the upper surface of the geomembrane. The nonconductive (insulating layer(s)) of the geomembrane act as a dielectric in a capacitor which stores electrical potential across the geomembrane.

4.2.2 A grid, test lanes or other acceptable system should be used to ensure that the entire area is tested with the test wand.

4.2.3 Either a hand held wand or a larger wand mounted to an all terrain vehicle may be used. Generally a hand held wand is a more efficient method unless the area is quite large and flat.

4.3 *Preparations and Measurement Considerations*

4.3.1 Testing must be performed on geomembranes that are clean and dry. For geomembrane covered by water or soils, other test procedures, such as described in Guide D6747 will have to be used for testing the geomembrane.

4.3.2 Fusion and extrusion welds must be tested using state of the practice nondestructive methods such as air channel test and vacuum box test, respectively. If the test wand gets too close to the edge of the conductive geomembrane, the electrical charge can arc to the back side of the conductive geomembrane and may cause a false positive.

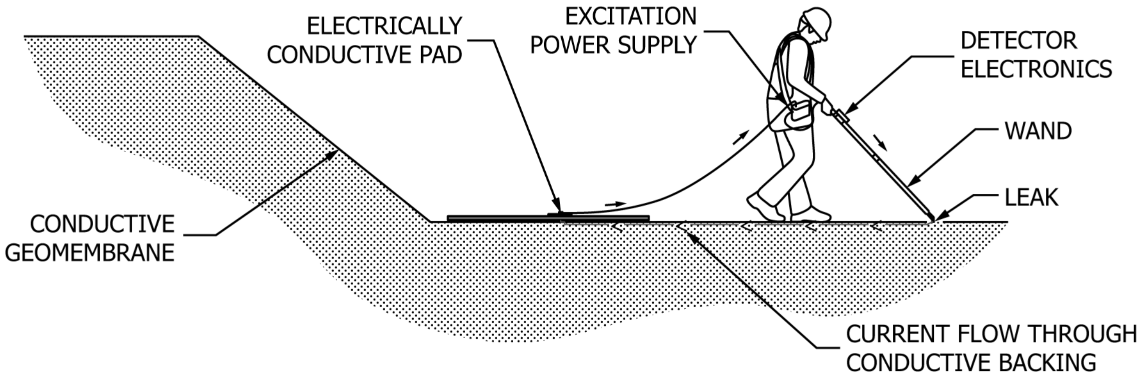

FIG. 1 ~~Wiring~~ Diagram of the ~~Equipment Required for Spark Testing Geomembrane in Intimate Contact With a Conductive Surface.~~Spark Testing Method

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 ~~that~~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, ~~or~~ unfolding ~~smaller~~ flexible geomembranes in the ~~field.~~ field, or a combination of both.

4.4 ~~In exposed geomembrane applications, geomembrane~~ 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 ~~final~~ and proven quality assurance measure to ~~locate previously undetected~~detect and locate leaks.

~~6. Procedure~~

~~6.1 Before beginning a leak survey, the equipment must be checked to ensure it is in working order. The power source should have a range of voltage from 15,000 to 35,000 volts. A wider voltage range is acceptable but the maximum is typically 35,000 volts. The test wand may be up to 6 feet wide with a brass brush. The coupling pad should be connected as shown in Fig. 1.~~

~~6.2 Once the equipment has been checked and wired properly, a trial test must be performed. A puncture (deliberate defect) should be introduced in a test piece of geomembrane. The deliberate defect should be approximately 1 mm in diameter. The test piece of geomembrane must be of sufficient size to enable movement of the brush at normal testing speed over the deliberate defect without touching the edges of the test piece or the coupling pad.~~

~~6.3 Place the test piece on a large scrap of geomembrane or on the installed geomembrane with the conductive side down. The deliberate defect and the coupling pad should both be on the large scrap piece of geomembrane.~~

~~6.3.1 Turn on the test unit and adjust the voltage and sensitivity to maximum settings.~~

~~6.3.2 Sweep the test piece with the wand ensuring that the test wand remains in contact with the geomembrane surface. It is important this be done at normal speeds.~~

~~6.3.3 Ensure the audible alarm sounds when the brush passes over the deliberate defect. If the alarm does not sound, recheck the connections and retest. If the alarm sounds prior to passing over the damage, turn the sensitivity down and retest the area. The minimum voltage required is site specific and will vary with atmospheric and other site conditions.~~

~~6.3.4 At a minimum, the equipment should be checked before testing begins and after any shut down of an hour or more. In the event a test reveals the equipment is not working properly, the entire area spark tested since the last passing check of the equipment will have to be retested to assure it was spark tested with working equipment.~~

~~6.4 Field testing may be performed by marking a pre-determined grid, using a two person team or another acceptable method.~~

~~6.5 The leak location survey shall be conducted using procedures whereby the test wand contacts every point on the surface of the geomembrane being surveyed for leaks – neglecting the edge effects.~~

~~NOTE 1—Welded seams cannot be tested using this method. They must be tested by test procedures appropriate for such items – this standard practice applies only to the sections of geomembrane in between the welded edges.~~

~~NOTE 2—Actual survey speed must be no greater than survey speed used during trial test.~~