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Standard Practice for Electrical Leak Location on Exposed Geomembranes Using the Water Puddle ~~System~~Method[1]

This standard is issued under the fixed designation D7002; 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,~~ practice is a performance-based standard for ~~electrical methods, covers detecting~~an electrical method for locating leaks in exposed 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 3.2.5).

1.2 This practice can be used for geomembranes installed in basins, ponds, tanks, ore and waste pads, landfill cells, landfill caps, canals, and other containment facilities. It is applicable for geomembranes made of materials such as polyethylene, polypropylene, polyvinyl chloride, chlorosulfonated polyethylene, bituminous geomembrane, and any other electrically insulating materials. This practice ~~may not be~~ is best applicable for locating geomembrane leaks where the proper preparations have ~~not~~ been made during the construction of the facility.

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

1.4 *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]

D4439 Terminology for Geosynthetics
D6747 Guide for Selection of Techniques for Electrical Leak Location of Leaks in Geomembranes
D7703 Practice for Electrical Leak Location on Exposed Geomembranes Using the Water Lance Method

[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.

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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 *artificial leak, n*—an electrical simulation of a leak in a geomembrane.

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

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.

~~3.2.4 *electrodes, n*—the conductive plate that is placed in earth ground or in the material under the geomembrane or a conductive structure, such as a copper manifold, that is placed in the water puddle on the geomembrane.~~

3.2.5 *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. ~~Leaks~~ Types of leaks detected during surveys ~~have been grouped into five categories:~~include, but are not limited to: burns, circular holes, linear cuts, seam defects, tears, punctures, and material defects.

~~3.2.5.1 *burned through zones*—voids created by melting polymer during welding.~~

~~3.2.5.2 *holes*—round shaped voids with downward or upward protruding rims.~~

~~3.2.5.3 *linear cuts*—linear voids with neat close edges.~~

~~3.2.5.4 *seam defects*—area of partial or total separation between sheets.~~

~~3.2.5.5 *tears*—linear or areal voids with irregular edge borders.~~

3.2.6 *leak detection sensitivity, n*—the smallest 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 likely be ~~reliably~~ detected.

3.2.7 *poor contact condition, n*—for the purposes of this practice, a poor contact condition means that a leak is not in intimate contact with the conductive layer above or underneath the geomembrane to be tested. This occurs on a wrinkle or wave, under the overlap flap of a fusion weld, in an area of liner bridging and in an area where there is a subgrade depression or rut.

3.2.8 *probe, n*—for the purposes of this practice, any conductive structure that is attached to a power source.

3.2.9 *squeegee, n*—for the purposes of this document, a squeegee is a device used to contain and push water on top of an exposed geomembrane. It may consist of a handle and a transverse piece at one end set with a strip of leather or ~~rubber.~~rubber, or a roller apparatus.

3.2.10 *water puddle, n*—a small pool of water placed on the geomembrane to create a conduit for current to flow through any leaks.

~~4. Summary of Practice~~

~~4.1 *Principle of Electrical Leak Location Method Using the Water Puddle System:*~~

~~4.1.1 The principle of the electrical leak location method is to place a voltage across a geomembrane and then locate areas where electrical current flows through discontinuities in the geomembrane and at seams.~~

~~4.1.2 Fig. 1 shows a diagram of the electrical leak location method of the water puddle system for exposed geomembranes. One output of an electrical excitation power supply is connected to an electrode placed in a water puddle created on top of the geomembrane. The other output of the power supply is connected to an electrode placed in electrically conductive material under the geomembrane.~~

~~4.1.3 Measurements are made using an electrical current measurement system, the magnitude of the current being related to the size of the leak. An electronic assembly is usually used to produce an audio tone whose frequency is proportional to the current flow.~~

~~4.2 *Leak Location Surveys of Exposed Geomembrane Using the Water Puddle System:*~~

~~4.2.1 The water puddle detection system usually consists of a horizontal water spray manifold with multiple nozzles that spray water onto a geomembrane, a squeegee device to push the resultant puddle of water, and a handle assembly as shown in Fig. 2. A pressurized water source, usually from a tank truck parked at higher elevation, is connected to the spray manifold using a plastic or rubber hose. Figs. 3 and 4 show one example of such an apparatus.~~

~~4.2.2 Direct current power supplies (usually a 12 or 24 volt battery) have been used for leak location surveys. An alternating current (output requirement of 12 to 30 volt ac) could be used.~~

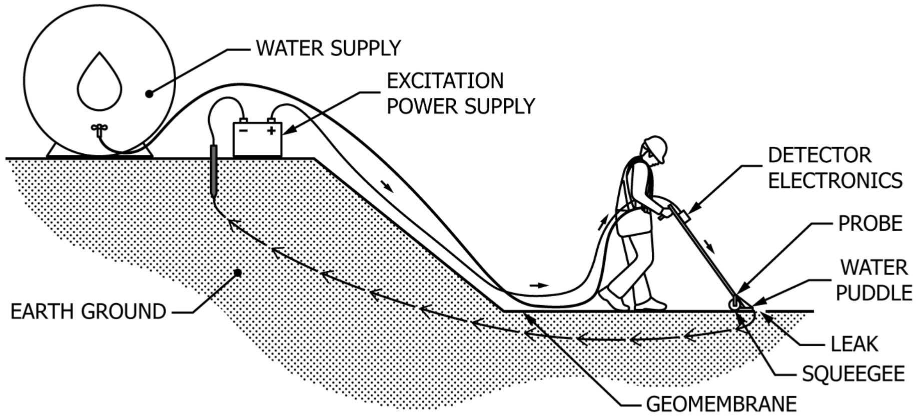

FIG. 1 Diagram of the ~~Electrical Leak Location Method for Surveys with Water Puddle on Exposed Geomembrane~~Water Puddle Method

~~4.2.3 For leak location surveys of exposed geomembrane, the water puddle created is pushed systematically over the geomembrane area to locate the points where the electrical current flow increases.~~

~~4.2.4 The signal from the probe is typically connected to an electronic detector assembly that converts the electrical signal to a detector and an audible signal that increases in pitch and amplitude as the leak signal increases.~~

~~4.2.5 When a leak signal is detected, the location of the leak is then marked or measured relative to fixed points.~~

~~4.2.6 The leak detection sensitivity can be very good for this technique. Leaks smaller than 1 mm in diameter are routinely found, including leaks through seams in the geomembrane.~~

~~4.2.7 The survey rate depends primarily on the manifold and squeegee width and the presence of wrinkles and waves in the geomembrane.~~

~~4.3 *Preparations and Measurement Considerations:*~~

~~4.3.1 Proper field preparations and other measures shall be implemented to ensure an electrical connection to the conductive material directly below the geomembrane is in place to successfully complete the leak location survey.~~

~~4.3.2 There shall be a conductive material below the geomembrane being tested. Leak location survey of geomembrane have been conducted with a conductivity of a subgrade equivalent to sand with moisture greater than 0.7 % (by weight). A properly-prepared subgrade typically will have sufficiently conductivity. Under proper conditions and preparations, geosynthetic clay liners (GCLs) can be adequate as conductive material. There are some conductive geotextiles with successful field experience which can be installed beneath the geomembrane to facilitate electrical leak survey (that is, on dry subgrades, or as part of a planar drainage geocomposite).~~

~~4.3.3 Measures should be taken to perform the leak location survey when geomembrane wrinkles are minimized.~~

~~NOTE 1—The leak location survey should be conducted at night or early morning when wrinkles are minimized. Sometimes wrinkles can be flattened by personnel walking or standing on them as the survey progresses.~~

~~4.3.4 For lining systems comprised of two geomembranes with only a geonet or geonet geocomposite between them, to make the method feasible a conductive layer such as a conductive geotextile shall be installed under the geomembrane or integrated into the geonet geocomposite.~~

~~4.3.5 For best results, conductive paths such as metal pipe penetrations, pump grounds, and batten strips on concrete should be isolated or insulated from the water puddle on the geomembrane. These conductive paths conduct electricity and mask nearby leaks from detection. See also Guide D6747.~~

~~4.3.6 Depending on specific construction practices and site conditions, other preparations and support may still be needed to successfully perform the leak location survey.~~

~~4.3.7 The system specifications are presented in Table 1.~~

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, 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.