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Standard Practice for Leak Location on Exposed Geomembranes Using the Water Puddle System[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 standard is practice, a performance-based practicestandard for electrical methods f, covers detecting leaks in exposed geomembranes. For clarity, this documentpractice uses the term "leak" to mean holes, punctures, tears, knife cuts, seam defects, cracks, and similar breaches in an installed geomembrane (as defined in 3.1.53.2.5).

1.2This standard 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.

1.3

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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

D4439 Terminology for Geosynthetics

D6747

D6747 Guide for Selection of Techniques for Electrical Detection of Potential Leak Paths in Geomembranes

3. Terminology

3.1 *Definitions:*

3.1.1

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.

3.1.2*electrodes*

3.2.2 *current*, *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.

3.1.3*—the flow of electricity or the flow of electric charge.*

3.2.3 *electrical leak location*, *n*—a method which uses electrical current or electrical potential to detect and locate leaks.

3.1.4*geomembrane*

3.2.4 *electrodes*, *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. —the conductive plate that is placed

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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.

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.

~~3.1.5~~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 detected during surveys have been grouped into five categories:

~~3.1.5.1~~

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.

~~3.1.5.2*tears*—linear or areal voids with irregular edge borders.~~

~~3.1.5.3~~

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

~~3.1.5.4~~

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

~~3.1.5.5*burned through zones*—voids created by melting polymer during welding.~~

~~3.1.6~~

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 be reliably detected.

~~3.1.7*current*~~

3.2.7 *squeegee*, *n*~~—the flow of electricity or the flow of electric charge.~~

~~3.1.8~~*—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.*

3.2.8 *water puddle*, *n*~~—for the purposes of this document, a water puddle is a small pool of water being contained and pushed by a squeegee installed on the leak location system.~~

~~3.1.9*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.~~

~~3.1.10*metalized geotextile*, *n*—a geotextile incorporating metallic strips that can conduct electrical current.~~ —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 ~~*The*~~ *Principle of* ~~*the*~~ *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)~~ac) could be used.

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*:

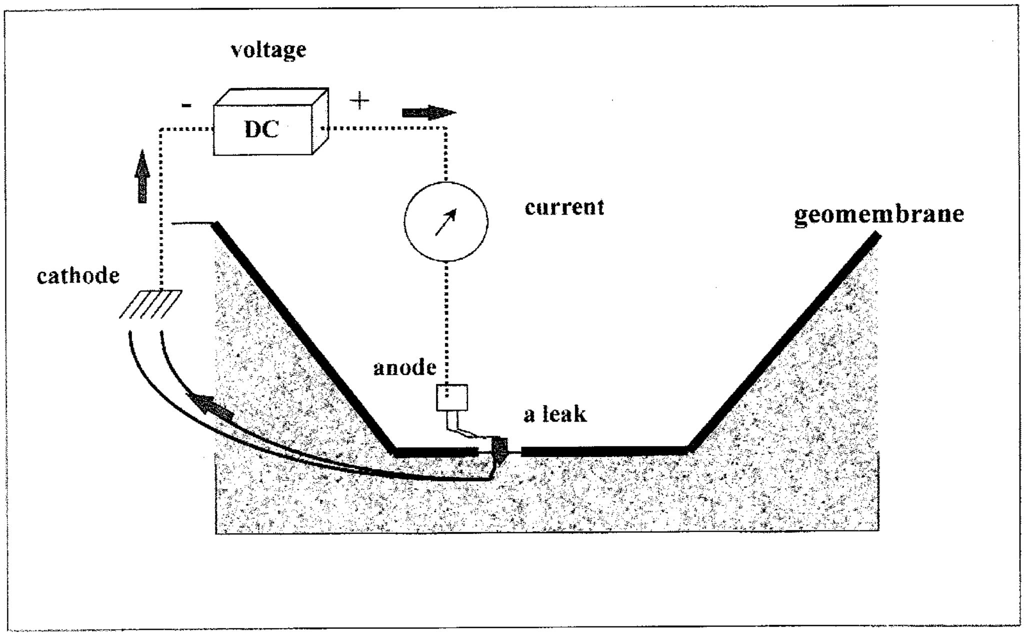

FIG. 1 Diagram of the Electrical Leak Location Method for Surveys with Water Puddle on Exposed Geomembrane

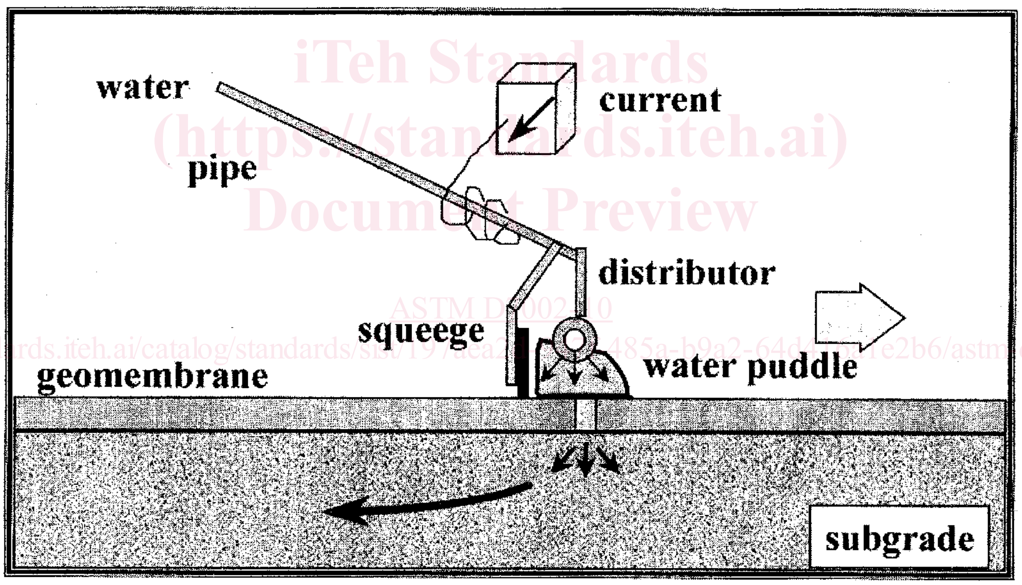

FIG. 2 Diagram of Electrical Leak Water Puddle System

~~4.3.1There must 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 (CGLs) can be also adequate.~~

~~4.3.2Measures should be taken to perform the leak location survey when geomembrane wrinkles are minimized. For flexible geomembranes, sometimes the wrinkles can be flattened by personnel walking on them immediately in front of the survey. For surveys with wrinkles in rigid geomembranes, the leak location survey should be conducted at night or early morning.~~

~~4.3.3For lining systems comprised of two geomembranes with only a geonet or geocomposite between them, the method is not applicable. For lining systems comprised of two geomembranes separated by a metalized geotextile, the method is applicable.~~

~~4.3.4For 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.~~

~~4.3.5The system specifications are presented in~~

4.3.1 Proper field preparations and other measures shall be implemented to ensure an electrical connection to the conductive