INTERNATIONAL

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

This standard is issued under the fixed designation D7703; 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 using the water lance system, a~~ standard for an electrical method for ~~detecting~~locating leaks in exposed geomembranes. For clarity, this ~~document~~practice uses the term "leak" to mean holes, punctures, tears, knife cuts, seam defects, cracks, and similar breaches in an installed ~~geomembrane.~~geomembrane (as defined in 3.2.5).

1.2 This ~~standard~~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 ~~electricallyinsulating~~ electrically insulating materials. This ~~standard may not be~~ practice is best applicable for locating geomembrane leaks where the proper preparations have ~~not~~ been made during the construction of the facility.

1.3 ~~Warning—The electrical methods used for geomembrane leak location could use high voltages, resulting in the potential for electrical shock or electrocution. This hazard might be increased because operations might be conducted in or near water. In particular, a high voltage could exist between the water or earth material and earth ground, or any grounded conductor. These procedures are potentially VERY DANGEROUS, and can result in personal injury or death. The electrical methods used for geomembrane leak location should be attempted only by qualified and experienced personnel. Appropriate safety measures must be taken to protect the leak location operators as well as other people at the site.~~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

~~D7007~~D7002 ~~Practices~~Practice for Electrical ~~Methods for Locating Leaks in Geomembranes Covered with Water or Earthen Materials~~Leak Location on Exposed Geomembranes Using the Water Puddle 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.

D7953 Practice for Electrical Leak Location on Exposed Geomembranes Using the Arc Testing Method

3. Terminology

3.1 ~~For general definitions used in this document, refer to D4439.~~*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 speciality 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.

~~3.2.3 *electrode, n*—the conductive plate that is placed in earth or in the material under the geomembrane or a conductive element typically placed inside the water reservoir.~~

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 *leak, n*—for the purposes of this ~~document,~~practice, 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~~ Type 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.

~~*holes*— round shaped voids with downward or upward protruding rims.~~
~~*tears*—linear or areal voids with irregular edge borders.~~
~~*linear cuts*—linear voids with neat close edges.~~
~~*seam defects*— area of partial or total separation between sheets.~~
~~*burned through zones*—voids created by melting polymer during welding.~~

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 rod that is attached to a power source.

3.2.9 *water stream, n*—for the purposes of this ~~document,~~practice, a continuous stream of water between the water lance and the geomembrane that creates a conduit for current to flow through any leaks.

3.2.10 *water lance, n*—for the purposes of this ~~document,~~practice, a probe (lance) incorporating one or two electrodes that directs a solid stream of water through a single nozzle mounted at the end.

~~4. Summary of Practice~~

~~4.1 *The Principle of the Electrical Leak Location Method Using the Water Lance 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 leaks. ASTM Standard D6747 is a guide for the selection of the various implementations of the method.~~

~~4.1.2 Fig. 1 shows a diagram of the electrical leak location method of the water lance system for exposed geomembranes. One output of an electrical excitation power supply is connected to an electrode placed in the water reservoir; a pump sends this charged water to the water lance (Fig. 2) that jets the water in a solid stream 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.~~

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

~~4.2.1 The water lance detection system usually consists of a single nozzle mounted at the end of a probe (lance) (Fig. 2) that directs a solid stream of water onto a geomembrane, and an electronic detector assembly as shown in Fig. 3. A pressurized water source, usually from a small reservoir on top of the liner, or from a tank truck isolated from ground parked at higher elevation, is connected to the water lance using a plastic or rubber hose.~~

~~4.2.2 Direct current power supplies (often a 12 or 24 volt battery) have been used for leak location surveys.~~

~~4.2.3 For leak location surveys of exposed geomembrane, the solid water stream (not a spray) is moved systematically over the geomembrane area to locate the points where the electrical current flow increases as the charged water from the water lance contacts the oppositely charged conductive media under the geomembrane through a hole.~~

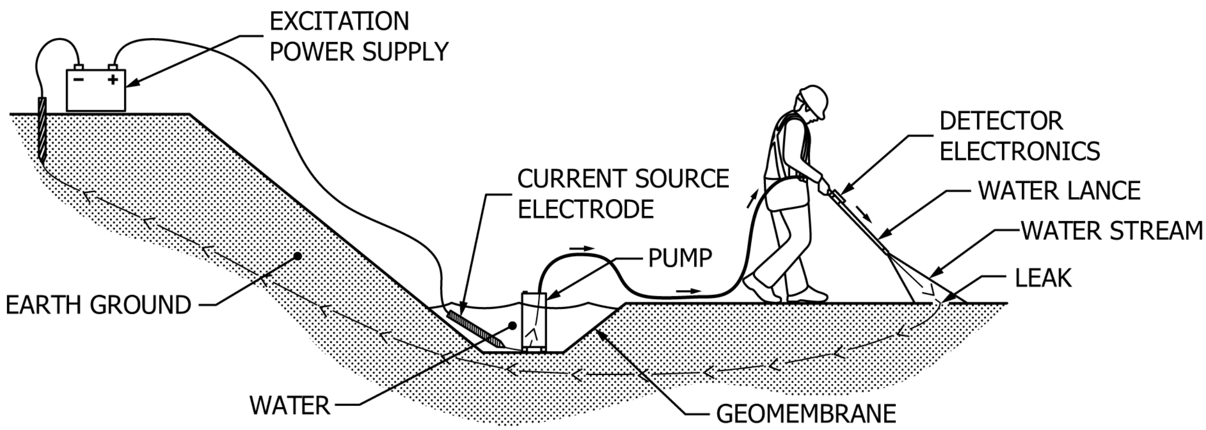
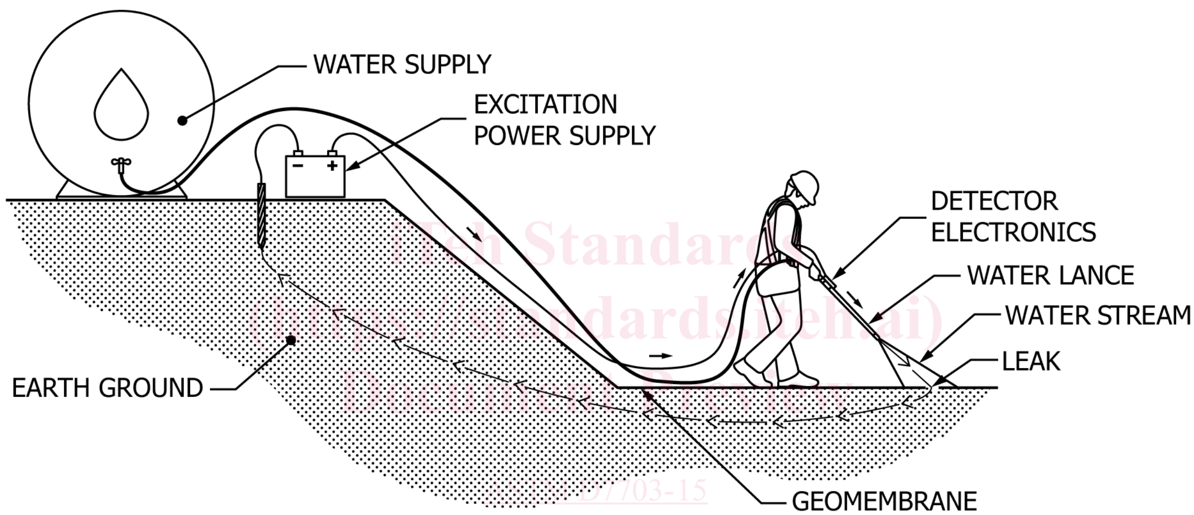


FIG. 1 Diagram of the ~~Electrical Leak Location Method for Surveys with Water Lance on Exposed Geomembrane~~Water Lance Method Using Voltage Measurement



~~**FIG. 2 Typical water lance**~~

FIG. ~~3~~2 ~~Photographs~~Diagram of the Water Lance ~~Electronic Detector Assembly~~Method Using Current Measurement

~~4.2.4 The voltage drop signal between the two electrodes in the water column in the water lance is typically connected to an electronic detector assembly that converts the electrical signal to an audible signal that increases in pitch and amplitude as the leak signal increases (Fig. 3).~~

~~4.2.5 When a leak signal is detected, the location of the leak is then marked or located 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.~~

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

~~4.3.1 Proper field preparations and other measures must be implemented to assure an electrical connection to the conductive material directly below the geomembrane is in place.~~

~~4.3.2 There must be a conductive material directly below the geomembrane being tested. Typically a properly-prepared subgrade will have sufficient 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 could 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. Condensation may provide a conductive layer under the geomembrane.~~

~~4.3.4 Conversely, surveys should not be made in areas with bridging geomembrane. The survey of areas with minor bridging might be accomplished when the geomembrane is warmer.~~