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Designation: ~~G62 – 14~~ G62 – 22

Standard Test Methods for Holiday Detection in Pipeline Coatings[1]

This standard is issued under the fixed designation G62; 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 These test methods cover the apparatus and procedure for detecting holidays in pipeline type coatings.

1.2 Method A is designed to detect holidays such as pinholes and voids in thin-film coatings from 0.025 to 0.254 mm (1 to 10 mils) in thickness using ordinary tap water and an applied voltage of less than 100 V d-c. It is effective on films up to 0.508 mm (20 mils) thickness if a wetting agent is used with the water. It should be noted, however, that this method will not detect thin spots in the coating. This may be considered to be a nondestructive test because of the relatively low voltage.

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1.3 Method B is designed to detect holidays such as pinholes and voids in pipeline coatings; but because of the higher applied voltages, it can also be used to detect thin spots in the coating. This method can be used on any thickness of pipeline coating and utilizes applied voltages between 900 and ~~20 000~~ 20 000 V d-c.[2] This method is considered destructive because the high voltages involved generally destroy the coating at thin spots.

1.4 The values stated in SI units to three significant decimals are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *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~~ 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:*[3]

A742/A742M Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe

3. Terminology

3.1 *Definitions:*

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[1] These test methods are under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee D01.48 on Durability of Pipeline Coating and Linings.

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[2] This was taken from the pamphlet "Operating Instructions for Tinker and Rasor Model EP Holiday Detector." Other manufacturers' holiday detectors can be expected to have similar voltage specifications.

[3] 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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3.1.1 *holiday, n*—small faults or pinholes that permit current drainage through protective coatings on steel pipe or polymeric precoated corrugated steel pipe.

3.1.2 *mil, n*—0.001 in.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *holiday detector, n*—a highly sensitive electrical device designed to locate holidays such as pinholes, voids, and thin spots in the coating, not easily seen by the naked eye. These are used on the coatings of relatively high-electrical resistance when such coatings are applied to the surface of materials of low-electrical resistance, such as steel pipe.

3.2.2 *pipeline type coating, n*—coatings of relatively high-electrical resistance applied to surfaces of relatively low-electrical resistance, such as steel pipe.

4. Summary of Test Methods

4.1 Both methods rely on electrical contact being made through the pipeline coating because of a holiday or a low-resistance path created by metal particles, or thin spots in the coating. This electrical contact will activate an alarm alerting the operator of the incidence of a holiday.

4.2 In Method A, the applied voltage is 100 V d-c or less.

4.3 In Method B, the applied voltage is 900 to ~~20 000 V d-c.~~20 000 V d-c.

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5. Significance and Use

5.1 *Method A*—Method A describes a quick, safe method for determining if pinholes, voids, or metal particles are protruding through the coating. This method will not, however, find any thin spots in the coating. This method will determine the existence of any gross faults in thin-film pipeline coatings.

5.2 *Method B*—Method B describes a method for determining if pinholes, voids, or metal particles are protruding through the coating, and thin spots in pipeline coatings. This method can be used to verify minimum coating thicknesses as well as voids in quality-control applications.

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6. Apparatus

6.1 *Low-Voltage Holiday Detector*—A holiday detector tester having an electrical energy source of less than 100 V d-c, such as a battery; an exploring electrode having a cellulose sponge dampened with an electrically conductive liquid such as tap water; and an audio indicator to signal a defect in a high-electrical resistance coating on a metal substrate. A ground wire connects the detector with the low-resistance metal surface.

6.2 *High-Voltage Holiday Detector*—A holiday detector tester having an electrical energy source of 900 to 20 000 V d-c; an exploring electrode consisting of wire brush, coil-spring, or conductive silicon electrode capable of moving along the pipeline coating; and an audio indicator to signal a defect in a high-electrical resistance coating on a metal substrate. A ground wire connects the detector with the low-resistance metal surface.

6.3 *Peak or Crest Reading Voltmeter*—A kilovoltmeter capable of detecting a single pulse and holding it long enough for the meter circuits to indicate.

7. Reagents and Materials

7.1 *Tap Water,* plain or with a wetting agent.

NOTE 1—Ordinary tap water will suffice to wet the sponge electrode when inspecting coatings up to 0.254 mm (10 mils) in thickness. On films between 0.254 and 0.508 mm (10 and 20 mils), a nonsudsing type wetting agent added to the water is recommended to allow for faster penetration of the liquid into pinhole defects.

8. Test Specimen

8.1 The test specimen shall be a representative length of production-coated pipe or polymeric precoated corrugated steel pipe.

9. Standardization of Instruments

9.1 The instruments shall be standardized with respect to voltage output in accordance with the manufacturer's instructions, using a peak or crest reading voltmeter. This is used more commonly with Method B where voltage may vary from test to test but can also be used for verification of the voltage on a Method A test.

9.2 The low-voltage holiday detector shall be standardized with respect to sensitivity by having the alarm activated when a selected resistance, having a ½ W rating, is placed across its terminals. A common factory setting for sensitivity is ~~100 000 Ω.~~ 100 000 Ω. Most units can be reset to any predetermined sensitivity value in this manner.

10. Procedure for Method A

10.1 Use the low-voltage holiday detector described in 6.1.

10.2 Assemble the wand and electrode according to the manufacturer's instructions and attach the ground wire to the metal surface.

10.3 Attach the electrode clamps to the end of the wand, dampen the sponge electrode with tap water, and place it between the clamps. Then tighten the clamps with the screw until they are well down into the sponge electrode. Attach the ground wire (lead with battery clamp) and the wand to the terminals. Clip the ground wire to some point where the metal surface is bare. Now touch the electrode to a second point where the surface is bare and note that the audible signal will be activated. The detector is now ready to operate by passing the damp sponge over the coated surface. When a holiday is picked up by the audible alarm, the electrode can be turned on end and the exact spot of failure can be noted by searching with the tip of the electrode.

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10.4 The voltage between the electrode (sponge) and the metal surface upon which the coating lies shall not exceed 100 V d-c, measured between the electrode sponge and the coated metal when the detector is in its normal operating position.

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10.5 Prior to making the inspection, ensure that the coated surface is dry. This is particularly important if formed surfaces are to be inspected. If the surface is in an environment where electrolytes might form on the surface, such as salt spray, wash the coated surface with fresh water and allow to dry before testing. Take care to keep the electrolyte at least 12.7 mm (½ ~~in.)~~ in.) from any bare sheared or slit edge.

10.6 A low-voltage holiday detector is not satisfactory for the inspection of pipeline coatings over 0.508 mm (20 mils) in thickness. This type of holiday detector will not detect thin spots in pipeline coatings.

11. Procedure for Method B

11.1 Use the high-voltage holiday detector. Method B can only be used for coatings that have a thickness of at least 500 µm (20 mils).

11.2 The test voltage needs to be selected so that it is below the electrical strength of the coating at the thickness to be tested, but above the voltage required to breakdown the air in any pinholes or flaws in the coating that will weaken the coating's protective properties.

The dielectric strength of air is typically 4000 V ⁄mm (100 V ⁄mil), but this value can be reduced if the air is humid, and the value is also influenced by air pressure. For a coating with a thickness of 500 µm (20 mils), the test voltage must be at least 2000 V (2.0 kV) in order that the air in the flaw can be made conductive so the resulting current flow can be detected.

~~Determine the~~An ideal test voltage ~~desired by multiplying the dielectric breakdown voltage per millimetre (mil)~~ will be midway between the minimum voltage required, that is, 4000 V ⁄mm and the dielectric strength of the coating ~~(at~~Note 2~~) times the~~ the thickness applied, for example, for a coating of 500 µm (20 mils) thickness and a dielectric strength of 6000 V ⁄mm (150 V ~~minimum allowable thickness of the coating in millimetres (mils).~~⁄mil), the minimum voltage is 2000 V and the maximum voltage at which there is considerable risk of damage to the coating is 3000 V. An ideal test voltage would therefore be 2500 V. This would ensure that flaws in the coating at this thickness would be detected.

NOTE 2—The dielectric breakdown voltage perTypical protective coatings have a dielectric strength of 6000 V millimetre/mm (6 kV (mil) can/mm or 140 V be determined for each coating experimentally as follows: Increase the holiday detector voltage over a known coating thickness and measure the voltage at the point where the detector will just begin to ring. Divide this voltage by the known coating thickness to obtain the amount of volts per millimetre/mil) or greater. Coatings with a dielectric strength of less than 5000 V (mil). This can also be obtained from most coating manufacturers' literature./mm can not be tested using Method B. Such coatings include those with additives that are conductive, such as metal particles or carbon black.

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DATA SHEET AND REPORT

Holiday Detection in Pipeline Coatings
Detector Type and Manufacturer ______ Report No. ______
Coating Manufacturer ______ Page ______ of ______
Coating ______
Production Date ______
Production Run No. ______
Applied by ______

Specimen	Coating Thickness		Detector Voltage	Test Method	Detector Resistance	Number of Holidays	Pipe Diameter	
	mm	mils			ohms		mm	in.

FIG. 1 Suggested Form for Use in Presenting Data for Method A and Method B