Designation: ~~G62 – 22~~ G62 – 23

Standard Test Methods for Holiday Detection ~~in Pipeline Coatings~~of Coatings used to Protect Pipelines[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~~procedures for detecting ~~holidays in pipeline type coatings.~~pinholes and holidays in coatings used to protect pipelines.

1.2 Method A is designed to detect ~~holidays such as~~ pinholes and ~~voids~~holidays in thin-film coatings from ~~0.025~~0.025 mm to 0.254 mm ~~(1 to 10 mils)~~ (1 mils 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)~~ 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.~~

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.~~ holidays in thick-film coatings >0.508 mm (20 mils) This method can be used on any thickness of pipeline coating and utilizes applied voltages between ~~900 and 20 000 V~~ 3.4 and 35 kV d-c. ~~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, health, and 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]

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

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

[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] 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.

D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

3. Terminology

3.1 *Definitions:*

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.~~an interruption in the normal physical structure or configuration of a coating such as cracks, laps, seams, inclusions, porosity, discontinuities, or areas of low coating thickness.

3.1.2 *mil, n*—0.001 in.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *dielectric strength, n*—the maximum voltage an insulating material can withstand without undergoing electrical breakdown. It is typically tested in accordance with Test Method D149.

3.2.2 *electrical breakdown, n*—a process that occurs when an insulating material, subjected to high enough voltage, suddenly becomes an electrical conductor and electrical current flows through it.

3.2.3 *electrode, n*—a conductive surface that is charged by the Holiday Detector and placed against the coating to be tested. Common electrode configurations include sponges for low voltage detectors and brushes and springs for high voltage detectors.

3.2.4 *high voltage voltmeter, n*—a device capable of measuring the voltage between the electrode and the ground connection of a High Voltage Holiday Detector. When used with a Pulse DC High Voltage Holiday Detector, the High Voltage Voltmeter shall be a peak reading voltmeter.

3.2.5 *holiday detector, n*—a highly sensitive electrical device designed to ~~locate holidays such as~~ detect holidays, pinholes, voids, and thin spots in ~~the coating, not easily seen by the naked eye. These are used on the coatings of~~ a coating having a relatively high-electrical resistance ~~when such coatings are~~ applied to ~~the surface of materials of low-electrical resistance,~~ a surface 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~~a pipeline coating because of a holiday or a low-resistance path created by metal ~~particles,~~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.~~3.4 kV d-c to 35 kV d-c.

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.~~Low voltage holiday detection is used to locate holidays and pinholes in thin-film coatings (up to 0.508 mm (20 mils) using a sponge wetted with tap water (and a wetting agent for coatings thicker than 10 mils). The water carries the current from the electrode through the holiday to the conductive substrate. The detector is grounded to the coated substrate. When the detector senses this flow of current it alarms.

5.2 *Method B*—~~Method B describes a method for determining if pinholes, voids, or metal particles are protruding through~~ High voltage holiday detection is used to locate holidays and pinholes in thick-film coatings (greater than 20 mils), but can be used on

coatings as low as 10 mils thick. A test voltage is selected and set. A charged Electrode is placed in contact with 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.~~the Detector is grounded to the coated substrate. When Electrical Breakdown occurs, electric current flows between the Detector's electrode and the conductive substrate and emits an audible alarm.

5.3 This standard does not apply to holiday detection of tape wraps used to protect pipe or coatings containing conductive raw materials such as conductive pigments and extenders.

5.4 The thickness of a coating applied to ductile iron pipe, fittings, or other iron castings may vary substantially due to the inherent roughness of the substrate. For these applications, consult the coating manufacturer for their recommended test voltage setting when using Method B. The coating manufacturer's recommended test voltage setting may be subject to approval by the owner.

NOTE 1— Use of voltage settings lower than those listed in this standard may increase the likelihood of non-detection.

6. Apparatus

6.1 *Low-Voltage Holiday Detector*—A ~~holiday detector tester~~ test device having an electrical energy source of less than 100 V d-c, such as a battery; an exploring electrode ~~having~~ equipped with 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~~ substrate; and a ground wire ~~connects~~connecting the detector with the low-resistance metal surface.

6.2 *High-Voltage Holiday Detector*—A ~~holiday detector tester~~ test device having an electrical energy source of ~~900 to 20 000 V~~ 3.4 kV d-c to 35 kV d-c; an exploring electrode consisting of a wire brush, coil-spring, or conductive silicon electrode capable of ~~moving~~traversing 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*~~ *High Voltage Voltmeter*—~~A kilovoltmeter capable of detecting a single pulse and holding it long enough for the meter circuits to indicate.~~peak reading voltmeter capable of measuring the voltage difference between the electrode (or part of the High Voltage Holiday Detector electrically continuous with, and at the same voltage as, the electrode), and the ground connection.

7. Reagents and Materials

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

NOTE 2—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~~0.254 mm and 0.508 mm ~~(10~~(10 mils and 20 mils), a ~~nonsudsing~~non-sudsing type wetting agent added to the water is recommended to allow for faster penetration of the liquid into ~~pinhole defects.~~pinholes.

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~~Calibration and Verification of Operation

~~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.~~

9.1 *Method A*—~~The low-voltage holiday detector shall be standardized~~ Low-voltage holiday detectors shall be calibrated annually by the equipment manufacturer, their authorized agent, or accredited calibration laboratory approved by the manufacturer and verified for proper operation prior to each use with respect to sensitivity by having the alarm activated when a selected resistance, having a ½~~W~~ W rating, is placed across its terminals. A common factory setting for sensitivity is 100 000 Ω. ~~Most~~Many units can be reset to any predetermined sensitivity value in this manner.

9.2 *Method B*—High-Voltage Holiday Detectors.

9.2.1 *Calibration*—High voltage detectors shall be calibrated annually by the equipment manufacturer, their authorized agent, or accredited calibration laboratory approved by the manufacturer in a controlled environment using a documented process. A Certificate of Calibration showing traceability to a National Metrological Institute shall be retained with the instrument.

9.2.2 *Verification*—Verification of the (a) output voltage and (b) overall function shall be performed before and after each period of use, if the detector has been dropped, or if the electrode or coating thickness changes.

9.2.2.1 *Two-point Verification of Output Voltage*—Ensure that the detector is properly grounded, and that the electrode to be used for testing is connected and in contact with the coating to be tested. Connect the ground connect from the High Voltage Voltmeter to the ground connector of the detector. Turn the detector on, set the voltage based on the expected/measured low coating thickness, and activate the voltage output. While the voltage output is activated, place the electrode of the High Voltage Voltmeter against the detector's electrode. The measured voltage on the High Voltage Voltmeter shall be within 10 % of the desired test voltage. If required, adjust the test voltage setting on the detector and reverify. Repeat this procedure based on the expected/measured high coating thickness.

NOTE 3— Some High Voltage Holiday Detectors contain an integrated High Voltage Voltmeter and means of adjusting the test voltage at the electrode automatically, thereby performing the above steps automatically.

9.2.2.2 *Functional Verification*—Locate a known holiday in the coating, where a small area (less than 1 mm [40 mils] diameter) of the substrate is exposed. Ensuring the Detector is properly grounded, place the electrode on the coating at least 25 mm (1 in.) away from the known Holiday. Turn on the Detector, activate the voltage output, and sweep the electrode across the known defect according to the procedure in Section 11. Ensure that the alarm activates when the electrode passes the known holiday.

10. Procedure for Method A

10.1 Use the low-voltage holiday detector conforming to that 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.~~instructions.

10.3 ~~Attach the electrode clamps to the end of the wand, dampen the~~ Dampen the sponge electrode with tap ~~water,~~water and place it between the ~~clamps. Then tighten the clamps with the screw until they are well down into~~clamps at the end of the wand, then tighten the clamps to secure 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~~ To verify operation, touch the electrode to a second point where the surface is bare and ~~note that~~ verify 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.~~is activated.

~~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.~~

10.4 ~~Prior to making the inspection, ensure that~~The detector is now ready to operate by passing the dampened sponge over the coated surface ~~is dry. This is particularly important if formed surfaces~~at a speed not to exceed 0.3 m/s (1 ft ~~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 (~~/~~s~~). When a holiday is detected, the electrode can be turned on end to locate the exact spot. Demarcate the location of the holiday/pinhole using a removable product such as chalk ~~½ in.) from any bare sheared or slit edge.~~or painter's tape.

~~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~~a high-voltage holiday detector conforming to that described in 6.2~~thickness of at least 500 µm (20 mils).~~.