Designation: G62 – 14

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.

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 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 and health practices and determine the applicability of regulatory limitations prior to use.*

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:*

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.

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

[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.

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.

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. 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.

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.

10.5 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.) 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.

11.2 Determine the test voltage desired by multiplying the dielectric breakdown voltage per millimetre (mil) of the coating (Note 2) times the minimum allowable thickness of the coating in millimetres (mils).

NOTE 2—The dielectric breakdown voltage per millimetre (mil) can 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). This can also be obtained from most coating manufacturers' literature.

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

11.2.1 An alternative method of determining test voltage is by use of one of the following equations depending on coating thickness.

11.2.2 If the coating thickness is less than 1.016 mm (40 mils):

$$V = M\sqrt{Tc} \quad (1)$$

where:

V = test voltage
Tc = coating thickness
M = 3294 if Tc is in millimetres
M = 525 if Tc is in mils.

11.2.3 If the coating thickness is greater than 1.041 mm (41 mils):

$$V = K\sqrt{Tc} \quad (2)$$

where:

V = test voltage
Tc = coating thickness
K = 7843 if Tc is in millimetres
K = 1250 if Tc is in mils

11.2.4 These equations are predicated on the amount of voltage needed to jump an air gap of the same length as the coating thickness. Therefore, they are useful for testing voids, pinholes and thin spots in the coating, but would not be useful as a coating thickness quality control tool.

11.3 Ground the test specimen by attaching the ground wire to a bare metal spot on the pipe surface. Plug the ground wire into the holiday detector. Then make up the searching electrode in accordance with the manufacturer's recommendations, using a brush wire or conductive silicon electrode. Plug the searching electrode into the holiday detector. Turn on the holiday detector.

11.3.1 **CAUTION:** Because of the high voltages involved, do not touch the ground wire and the metal part of the electrode at the same time if the instrument is on.

11.4 The detector is now ready to operate by passing the electrode over the test specimen. The detector will ring if it passes any void, pinhole, or area of the coating thinner than the minimum allowable thickness. When a holiday is detected by the audible alarm, the electrode can be repositioned to determine the exact holiday area by observing the origin of the spark jump.

11.5 Prior to making the inspection, ensure that the coated surface is dry. Dryness is critical in a high voltage test. Take care to keep the electrode at least 12.7 mm (½ in.) from any bare sheared or slit edge.

12. Report

12.1 The report shall include the following (see Fig. 1):

12.2 Complete identification of the specimen including names and code number of the coating, pipe diameter, source, production data, and production run number. For polymeric precoated corrugated steel pipe, the reporting requirements of Specification A742/A742M shall be used for identification,

12.3 Name and type of instrument used, method of standardization, and whether Method A or Method B was used, and

12.4 If Method B was used, state the test voltage, the method used to calculate the voltage, and the minimum allowable thickness in millimetres (mils) of the test sample.

13. Precision and Bias

13.1 Precision data are limited to adjacent specimens taken from the production-coated pipe as for the polymeric corrugated steel pipe assuming that the production process was uniform with respect to pipe surface condition and coating material. Specimens that were not adjacent in the as-produced condition, or were taken from different lengths of pipe, may represent differing process conditions.

13.2 *Repeatability*—When the same instrument is used by the same operator, duplicate measurements on the same specimen shall agree within ±5 %.

13.3 *Reproducibility*—Different operators using different instruments, set at the same voltage, inspecting the same specimen shall obtain average results agreeing with each other within ±10 %.

13.4 *Bias*—This test detects the presence of a conductive path through the coating and is therefore not a measurement. No value for bias can be determined.

14. Keywords

14.1 holiday detector; holidays; piping; pinhole; wet sponge detector