Designation: G55 – 07 (Reapproved 2019)

Standard Test Method for Evaluating Pipeline Coating Patch Materials[1]

This standard is issued under the fixed designation G55; 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 test method provides an accelerated means of determining the relative sealing abilities of pipeline patching materials that are used to seal holidays in pipeline coatings on steel pipe. This test method is intended for utilization of specimens of pipeline coatings on small-diameter pipe, for representing coatings used for buried or submerged service, and where the purpose of the coating is to provide an electrical barrier between the steel pipe and its environment.

1.2 This test method is not intended for evaluating patch materials that are overlapped upon themselves.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

1.5 *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. Summary of Test Method

2.1 Patched pipeline coating specimens are suspended in an aqueous, alkaline, low-resistivity electrolyte. The specimens are individually connected to a magnesium anode or rectifier at a point external to the electrolyte. The coated, patched pipeline specimens are sealed at the base and at all other areas except the patch boundaries, such that the only paths for current flow are at the boundaries of the patches. Current flow in each patch area is averaged from monthly readings taken for one year.

3. Significance and Use

3.1 Holidays in pipeline coatings may be repaired by circumferential wrapping with a suitable pipe wrap tape. However, this technique is not always practicable and patching may be required. The effectiveness of a patch material depends upon its adhesion to the original pipeline coating to effect sealing.

3.2 The results of this accelerated test have been found to yield comparative data useful for the selection of patching materials. The user is cautioned against the use of this method for absolute material properties characterization.

3.3 This procedure provides an accelerated method by exposing the patch to a severe radius of curvature on small-diameter pipe. The specimen is also exposed to a stress voltage in the presence of a highly conductive electrolyte.

4. Apparatus

4.1 *Test Vessel*—A cylindrical glass battery jar (or equivalent), approximately 300 mm (12 in.) in diameter and 300 mm in height. One magnesium anode shall be contained in each battery jar, with a maximum of eight pipe specimens, and with each specimen measuring about 25 mm (1 in.) in diameter by approximately 300 mm in length of coated pipe. (See 4.3 and Fig. 1 and Fig. 2.)

4.2 *Suspension*—The suspension ring for supporting the pipe specimens shall be an electrically nonconductive circular disk, measuring approximately 300 mm (12 in.) in diameter and approximately 5 mm (3⁄16 in.) in thickness. (See 6.4.) Drill a 15-mm (½-in.) diameter hole through the center of the ring for external extension of the anode lead wire. Drill eight suspension holes, about 45 mm (1¾ in.) in diameter, through the suspension ring for the pipe specimens; these holes shall be centered 110 mm (4½ in.) from the center of the suspension ring and evenly spaced around the ring at 45° increments as measured from the center of the suspension ring.

4.3 *Potential*—A high-purity magnesium anode shall be used, weighing approximately 2.3 kg (5 lb), and having an open-circuit potential of approximately 1.7 d-c V relative to a copper-copper sulfate electrode, and complete with a factory-sealed lead wire. The magnesium anode may be replaced by a controlled d-c voltage from a rectifier, and then maintaining the potential between the specimen having the least current flow

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

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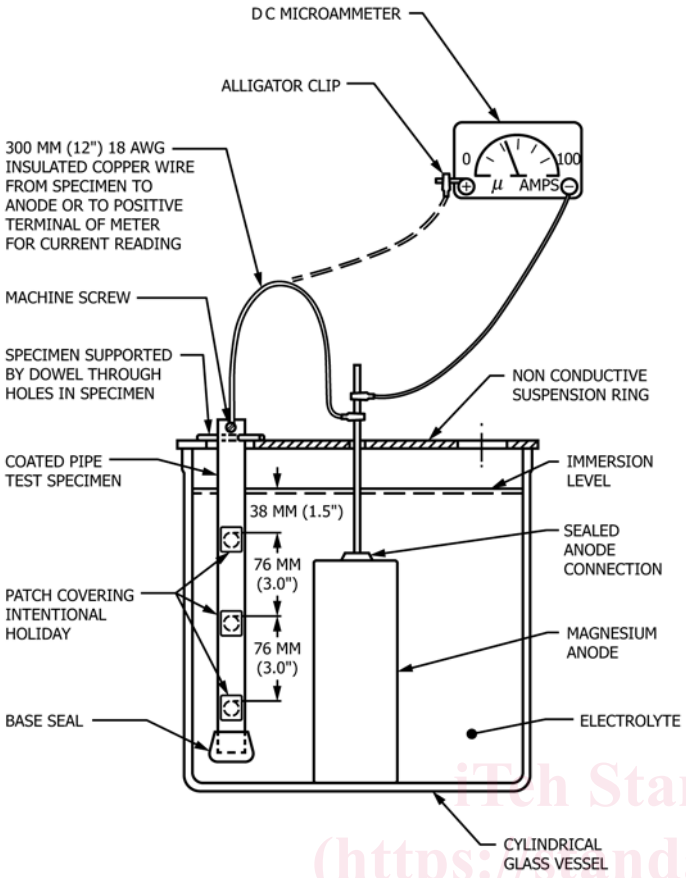

FIG. 1 Test Assembly for Evaluating Pipeline Coating Patch Materials

and a copper-copper sulfate reference cell (with the cell being properly immersed in the electrolyte) at 1.50 ± 0.05 d-c V. (See Note 1.) The anode should be composed of a suitable nonconsumable material.[2] This option will avoid the precipitation of magnesium salts on the specimens.

NOTE 1—The potential of the magnesium anode will approximate this range over the life of the test. If a calomel electrode is used for the reference cell, the potential should be – 1.43 ± 0.05 d-c V.

4.4 *Electrolyte*—Use 1 % each by weight of anhydrous pure grades of sodium chloride, sodium sulfate, and sodium carbonate, dissolved in either distilled water or demineralized water. This electrolyte shall never be less alkaline than pH = 10.0 and should be within a resistivity range from 20 to 35 Ω · cm.

4.5 *Instruments:*

4.5.1 *Resistivity Meter,* capable of measuring 20 to 40 Ω · cm in an aqueous solution.

4.5.2 *pH meter,* capable of measuring 0 to 14 pH.

4.5.3 *Thermometer,* ASTM Type 17C or equivalent, 19 to 27°C.

4.5.4 *Microammeters,* d-c, 0 to 100-μA and 0 to 500-μA.

4.5.5 *Voltmeter,* for direct current, having an internal resistance of not less than 10 MΩ and having a range from 0.01 to 5.0 V.

4.5.6 *Full-Wave Rectifier,* optional, 0 to 0.05 % ripple, capable of maintaining 1.50 ± 0.05 d-c V relative to a copper-copper sulfate cell, and having a capacity for at least 10 A of direct current.

5. Test Specimens

5.1 *Dimensions*—The specimen shall be steel pipe approximately 25 mm (1 in.) in diameter, approximately 300 mm (12 in.) in length, and previously coated with the desired original pipeline coating.

5.2 *Circuit Tap*—A 5-mm (3⁄16-in.) diameter hole shall be drilled or tapped (or a self-tapping screw may be used) at a point 13 mm (½ in.) below the top of each specimen. This tap is for a machine screw anode lead wire connection.

5.3 *Pipe Suspension Support Holes*—A 6-mm (¼-in.) diameter hole shall be drilled completely through both walls of the coated pipe specimen at a point 20 mm (¾ in.) from the top end of the specimen and located vertically beneath the circuit tap hole. A short length of wooden dowel pin about 5 mm (3⁄16 in.) in diameter shall be used as an insertion through the suspension holes to support and level the pipe specimen on the circular suspension ring when the suspension ring is mounted on the battery jar.

5.4 *Intentional Holidays*—A 4-fluted 13-mm (½-in.) diameter facing bit shall be used to drill intentional holidays through the original pipeline coating to the metal. Drilling such holidays shall be practiced on scrap pieces of small-diameter coated pipe, prior to drilling the holidays in the test specimens. Drilling shall not be any deeper than necessary into the metal of the pipe. Three holidays shall be prepared on each specimen in a vertical line directly underneath the circuit tap to correspond to electrolyte immersions of 38 mm (1½ in.), 114 mm (4½ in.), and 190 mm (7½ in.), as measured from the top of the holiday to the surface of the electrolyte. The thickness of the suspension ring shall be considered for its effect in elevating the pipe specimens in the electrolyte.

5.5 *Patches*—A square patch configuration of 25 by 25 mm (1 by 1 in.), evenly centered about the holiday, shall be lightly marked. This will provide a minimum patch overlap of 6 mm (¼ in.) as measured perpendicular to the center of each patch edge to the circumference of the holiday. The top and bottom edges of each patch shall be in the horizontal plane. Each marked patch area shall be lightly buffed with 120-grit sandpaper. A primer shall be applied using clean cotton on a stick to extend the primer to the edges of the marked patch area when specified by the manufacturer of the patch. The manufacturers' specified drying time shall be used for primers before application of the patch. Scissors or a knife shall be used to cut tape patches to size; tape patches shall be applied by a firm pressure of the thumb. Wax patches shall be applied by dripping or pouring the melted wax on the patch area to the desired patch thickness. Each mastic patch or each liquid patch shall be applied with a new, clean brush. The number of coats

[2] The sole source of supply of a nonconsumable anode, Durachlor 51 anode, Type B, 18-in. with cable, known to the committee at this time is Duriron Co., P.O. Box 1145, Dayton, OH 45401. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.