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Designation: G18 – 07

StandardTest Method for Joints, Fittings, and Patches in Coated Pipelines[1]

This standard is issued under the fixed designation G18; 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 describes determination of the comparative corrosion preventative characteristics of materials used for applications to joints, couplings, irregular fittings, and patched areas in coated pipelines. The test method is applicable to materials whose principal function is to act as barriers between the pipe surface and surrounding soil environment.

1.2 The test method described employs measurements of leakage current, capacitance, and dissipation factor to indicate changes in the insulating effectiveness of joint and patching materials.

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

1.5 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.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

G12 Test Method for Nondestructive Measurement of Film Thickness of Pipeline Coatings on Steel

3. Summary of Test Method

3.1 The test method consists of an immersion test where coated pipe specimens, each containing a simulated joint, tee, or patched area, are suspended in an electrolyte and placed under cathodic protection by connecting the specimens to the negative (–) terminal of a 6-V d-c power supply (see Fig. 1). An anode, also immersed in the electrolyte and connected to the positive (+) terminal of the power supply, completes the test circuit. Joint or patch performance is followed through periodic determinations of leakage current measured as voltage drops across a calibrated resistor in the anode-to-cathode circuit.

3.2 Capacitance and dissipation factor measurements are used to supplement the periodic leakage current determinations.

4. Significance and Use

4.1 The exposed metal surfaces at joints, fittings, and damaged areas in an otherwise coated pipeline will be subjected to corrosion if allowed to come in contact with the soil environment. The performance of joint and patching materials designed to function as protective coverings will depend upon such factors as the ability of the material to bond to both the pipe coating and exposed metal surfaces, the integrity of the moisture seal at lapped joints, and the water absorption characteristics of the joint material.

4.2 The existence of substantial leakage current through the coating joint, patch, or fitting is reliable evidence that the material has suffered a significant decrease in its performance as a protective barrier. In a similar manner, measured changes in joint capacitance and dissipation factor are useful because they are related to the water absorption rate of the joint material. Water permeating an insulating barrier increases its capacitance and its progress can be measured through the use of a suitable impedance bridge.

5. Apparatus

5.1 *Test Vessel,* nonconducting, shall be used to contain the test specimens. Dimensions of the vessel shall permit the following requirements:

5.1.1 The test vessel shall be large enough to allow for suspension of the specimens in a vertical position and equidistant from a centrally located anode. The specimens shall not touch either each other, the walls, or bottom of the test vessel.

5.1.2 The test vessel shall be deep enough to allow for immersion of the specimens in the electrolyte to the lower edge of the upper moisture shield (see Fig. 2).

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[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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[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.

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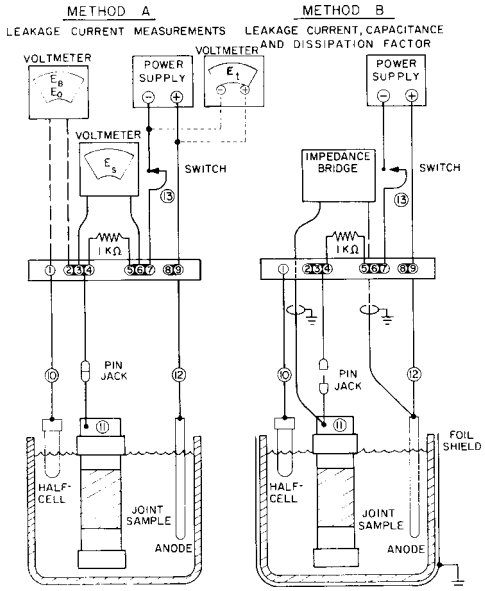


FIG. 1 Test Circuits

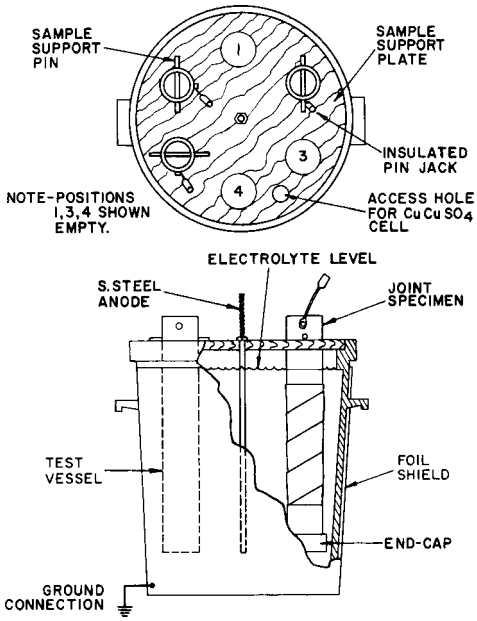
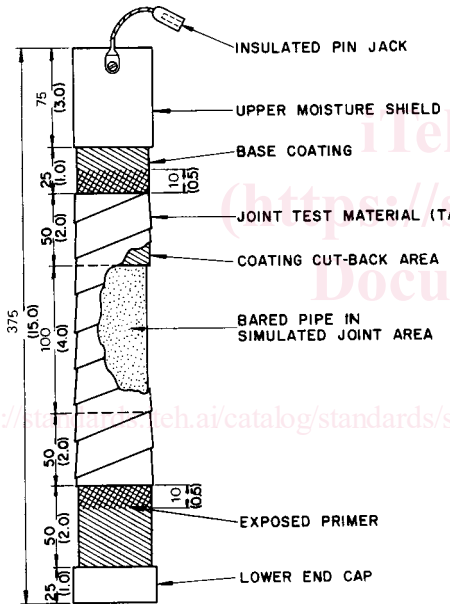


FIG. 3 Joint Test Cell



NOTE 1—All dimensions are in millimetres with inches in parentheses.

FIG. 2 Joint Test Specimen

NOTE 1—A commercially available, 42 L (11-gal) waste container of high-density polyethylene can be conveniently used as a test vessel and will accommodate up to six test specimens of a size indicated in 7.2.

5.2 *Support Plate,* fabricated from a nonconductive material, to suspend the specimens in the test vessel. The support plate shall contain an access hole for the reference electrode. A typical test cell is illustrated in Fig. 3.

5.3 *Anode,* fabricated from 9.525 mm (0.375-in.) diameter 300 series stainless steel rod, 609.6 mm (24.00 in.) long. Other inert anodes such as carbon or platinum may be used.

5.4 *D-C Voltmeter,* to serve the dual purpose of (*1*) measuring leakage current as a potential drop across a 1,000-Ω shunt in the measuring circuit and (*2*) measuring the potential of the test specimen with reference to a Cu-$CuSO_4$ half cell. The instrument characteristics for these functions shall be:

5.4.1 *Voltage Range*—50 μV full scale to 10 V full scale in overlapping 1× and 3× ranges.

5.4.2 *Accuracy*—±3 percent of full scale on all ranges.

5.4.3 *Input Resistance*—Greater than 10 MΩ on all ranges.

5.5 *Thickness Gage*—Measurements of coating thickness will be required for this test. Any instrument suitable for use with Test Method G12 can be used. However, the choice of measuring gage shall be compatible with the joint coating thickness that will be encountered in the test.

5.6 *Ohmmeter*—Measurements for end-cap integrity shall be made with a suitable ohmmeter capable of reading resistance to an upper limit of 1000 MΩ ±5 %.

5.7 *Reference Electrode*—A Cu-$CuSO_4$ half cell of conventional glass or plastic tube with porous plug construction, but preferably not over 19.05 mm (¾ in.) in diameter, having a potential of – 0.316 V with respect to the standard hydrogen electrode.

NOTE 2—A saturated calomel half cell may be used, but measurements made with it shall be converted to the Cu-$CuSO_4$ reference for reporting by adding – 0.072 V to the observed reading.

5.8 *Voltage Source*—A battery or rectifier-type power supply shall be used to maintain a potential difference of 6.0 ± 0.1 V dc between each of the test specimens and the Cu-$CuSO_4$ half cell. Where multiple specimens are tested, a suitable voltage-dividing circuit will be required for individual control of the voltage applied to each specimen.

5.9 *Circuit Wiring* from the anode to specimen shall be of No. 18 Awg insulated copper. A switch for disconnecting each specimen from its voltage source shall be included in the circuit. A1000 Ω ±1 percent, 1-W (minimum) precision resistor shall be placed in the anode-to-cathode circuit as a shunt for current. A diagram illustrating the test cell wiring appears as Fig. 1.

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