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.

Designation: G33 – 99 (Reapproved 2020)

Standard Practice for Recording Data from Atmospheric Corrosion Tests of Metallic-Coated Steel Specimens[1]

This standard is issued under the fixed designation G33; 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 practice covers a procedure for recording data of atmospheric corrosion tests of metallic-coated steel specimens. Its objective is the assurance of (*1*) complete identification of materials before testing, (*2*) objective reporting of material appearance during visual inspections, and (*3*) adequate photographic, micrographic, and chemical laboratory examinations at specific stages of deterioration, and at the end of the tests.

1.2 *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.*

1.3 *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]

A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

A428/A428M Test Method for Weight [Mass] of Coating on Aluminum-Coated Iron or Steel Articles

E376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Testing Methods

G46 Guide for Examination and Evaluation of Pitting Corrosion

3. Significance and Use

3.1 Use of this practice will maximize the benefits to be gained from atmospheric testing of metallic-coated steel. It will also aid in comparing results from one location to another where similar tests have been conducted.

4. Data to be Recorded Before Testing

4.1 *Material Characteristics:*

4.1.1 Coating and Basis Metal:

4.1.1.1 Type of coating (zinc, aluminum, nickel-chromium, and so forth).

4.1.1.2 Method of application (hot-dip, electroplated, electroless, mechanical plated, and so forth),

(1) Area coated (if not 100 % of surface),

(2) Pre-treatment (basis metal: flux, sand-blast, and so forth), and

(3) Post-treatment (heating, sealing, and so forth),

4.1.1.3 Coating composition,

4.1.1.4 Basis metal product.

(1) Basis metal composition, and

(2) Metallurgical history prior to coating (if any).

4.1.1.5 Chemical treatment of coating.

4.1.1.6 Black and white photograph of typical surface area illustrating texture (1:1 magnification ratio).

4.1.1.7 Micrograph of typical coating cross section (magnification and etchant to be specified).

4.1.2 Coating Weight and Thickness:

4.1.2.1 Weight by stripping. (See Test Method A90/A90M or A428/A428M.)

(1) Method.

4.1.2.2 Measured Thickness.

(1) Method (for example, eddy current, back scattering, magnetic),

NOTE 1—If a magnetic type instrument is used, refer to Practice E376.

(2) Number of determinations,

(3) Mean,

(4) Standard deviation, and

(5) Range (spread of determinations).

4.2 *Specimen Identification and Exposure Location:*

4.2.1 Marking (method to be specified).

4.2.2 Specimen position in test area.

4.2.3 Angle of exposure from horizontal.

[1] This practice is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.04 on Corrosion of Metals in Natural Atmospheric and Aqueous Environments.

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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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4.2.4 Direction of specimen faces.

4.2.5 Location of test area.

4.2.6 Description of test area (location of nearby industry, ocean, and so forth, and recorded data on specific contaminants where possible).

4.2.7 Exposure starting date:

4.2.7.1 Weather conditions (for example, bright, cloudy, sunshine, rain, and so forth),

4.3 *Specimen Characteristics:*

4.3.1 Description (sheet, wire, hardware, and so forth).

4.3.2 Specimen size:

4.3.2.1 Specimen surface dimensions.

4.3.2.2 Gage or thickness.

4.3.3 Specimen weight (when applicable).

4.3.4 Edge condition (to be specified).

4.3.5 Specimen preparation (method of cleaning).

4.3.6 Surface appearance (verbal description, color, texture, and so forth) (see 5.3).

5. Data to be Recorded During Field Inspections

5.1 *Specimen Identification:*

5.1.1 Marking.

5.1.2 Position in test area.

5.2 *Exposure Period and Location:*

5.2.1 Location.

5.2.2 Inspection date.

5.2.2.1 Weather conditions (for example, bright, cloudy, sunshine, rain, and so forth).

5.3 *Specimen Appearance (Top and Bottom Sides Should be Rated Separately):*

5.3.1 Color:

5.3.1.1 *Hue*—should be described by the following terms: red, orange, yellow, green, blue, violet, white, brown, gray, and black. Combination colors should be described by combining terms, for example, yellow-brown.

5.3.1.2 *Brilliance*—should be described by light or dark.

5.3.1.3 *Saturation*—should be described by pale or vivid.

5.3.1.4 *Area*—of the specimen affected should be expressed in percent.

5.3.2 Surface Texture:

5.3.2.1 The following terms should be used to describe the surface texture:

(1) Lustrous—Having a high degree of specular reflectivity,

(2) Semi-lustrous—Having a slight degree of reflectivity,

(3) Matte—Without gloss or luster but having a smooth surface to touch,

(4) Chalky—Having a matte surface with a powdery surface layer that can be wiped off with a finger touch,

(5) Grainy—Having a uniformly roughened surface detectable by touch, and

(6) Pebbly—Having a rough and irregularly indented surface.

5.3.2.2 The area of the specimen affected should be expressed in percent.

5.3.3 Local Surface Irregularities:

5.3.3.1 The following terms should be used to describe surface irregularities:

(1) Blistering—Any separation of the coating from the substrate not accompanied by peeling,

(2) Peeling—Separation of the coating from the substrate initiating at an edge of or cut in the coating and causing an exposure of the substrate,

(3) Cracking—Any fissure in the coating other than a mechanical cut,

(4) Checking—Cracking in a cross-hatch manner resembling mud cracking,

(5) Rust—Corrosion products of iron characterized by rough, reddish brown particles. Rust is always rough to the touch,

(6) Tubercles—Knob-like protrusions of corrosion products,

(7) Nodules—Little lumps, and

(8) Pits—Cavities or holes in the metal surface.

5.3.3.2 Blisters, cracks, nodules, tubercles, and pits should be reported by number and size. Peeling, checking, and rust should be reported by percent area affected.

6. Data to Be Recorded When Samples Are Removed at the Conclusion of the Test

6.1 *Specimen Identification:*

6.1.1 Marking.

6.1.2 Position in test area.

6.2 *Exposure Period and Location:*

6.2.1 Location.

6.2.2 Weather conditions (for example, bright, cloudy, sunshine, rain, and so forth).

6.2.3 Removal date.

6.2.4 Exposure time in years (fractions as decimals to nearest tenth).

6.3 *Specimen Appearance (Top and Bottom Sides Should be Rated Separately) (See 5.3):*

6.3.1 Color.

6.3.2 Surface texture.

6.3.3 Local surface irregularities.

6.4 *Specimen Characteristics:*

6.4.1 Black and white photographs to illustrate typical features (magnification ratio 1:1).

6.4.2 Microsections of coating on panel to be specified at beginning of tests to record any inter-granular corrosion, penetration to base metal, penetration along base metal-coating interface, nature of attack at the heaviest corrosion site on the specimen, and other significant details (magnification and etchant to be specified).

6.5 *Coating Mass Loss and Thickness Determination:*

6.5.1 Coating mass determined by stripping (mass loss).

6.5.1.1 Removal of corrosion product-method.

6.5.1.2 Weight before stripping.

6.5.1.3 Stripping of coating-method.

6.5.1.4 Weight after stripping.

6.5.1.5 Mass loss of control (unexposed panel(s)) using above procedure (6.5.1).

6.5.1.6 Net mass loss due to exposure after applying control panel correction (mass loss exposed panel(s) minus mass loss control panel(s)).

6.5.2 Measured coating thickness after cleaning.

6.5.2.1 Method.

6.5.2.2 Number of determinations.

6.5.2.3 Mean.

6.5.2.4 Standard deviation.

6.5.2.5 Observed range.

6.5.2.6 Average thickness loss due to exposure.

6.5.3 In the event residual coating mass determinations are desired on partially rusted specimens, the determination should be made by analyzing the stripping solution for the coating metal.

7. Exceptions to Practice

7.1 In specific instances there will undoubtedly be cases where the procedure should be expanded in certain areas. For example:

7.1.1 Depth of deepest pit, if pitting is present.

7.1.2 Average depth of ten deepest pits, if pitting is present. (See Guide G46.)

7.1.3 Coating mass on each surface.

7.1.4 Coating mass loss on each surface.

7.2 In certain instances, lack of information or other factors may make it impossible or impractical to obtain data for each point in the practice. Any deletions or omissions from the practice should be noted by the experimenters with a brief explanation of why the omission was made.

8. Keywords

8.1 atmospheric corrosion; mass loss; metallic coatings; pitting

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