Designation: G50 – 10 (Reapproved 2015)

Standard Practice for Conducting Atmospheric Corrosion Tests on Metals[1]

This standard is issued under the fixed designation G50; 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 and defines conditions for exposure of metals and alloys to the weather. It sets forth the general procedures that should be followed in any atmospheric test. It is presented as an aid in conducting atmospheric corrosion tests so that some of the pitfalls of such testing may be avoided. As such, it is concerned mainly with panel exposures to obtain data for comparison purposes.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A380 Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

D2010/D2010M Test Methods for Evaluation of Total Sulfation Activity in the Atmosphere by the Lead Dioxide Technique

G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens

G33 Practice for Recording Data from Atmospheric Corrosion Tests of Metallic-Coated Steel Specimens

G46 Guide for Examination and Evaluation of Pitting Corrosion

G84 Practice for Measurement of Time-of-Wetness on Surfaces Exposed to Wetting Conditions as in Atmospheric Corrosion Testing

G91 Practice for Monitoring Atmospheric SO_2 Deposition Rate for Atmospheric Corrosivity Evaluation

G92 Practice for Characterization of Atmospheric Test Sites

G140 Test Method for Determining Atmospheric Chloride Deposition Rate by Wet Candle Method

3. Significance and Use

3.1 The procedures described herein can be used to evaluate the corrosion resistance of metals when exposed to the weather, as well as to evaluate the relative corrosivity of the atmosphere at specific locations. Because of the variability and complexity of weather effects and the industrial and natural factors influencing the atmospheric corrosivity of a test site, a multi-year exposure period should be considered to minimize their influence. Also, as corrosivity may vary at a site from season to season, exposures should be made either at the same time of the year to minimize variability or these differences should be established by multiple exposures.

3.2 Control specimens should always be employed in weathering tests. The control specimens should be from a material having established weathering characteristics. A substantial amount of corrosion data shall have been accumulated for the control specimens. It is also good practice to retain samples of all materials exposed so that possible effects of long-term aging can be measured.

4. Test Sites

4.1 Test sites should be chosen at a number of locations representative of the atmospheric environments where the metals or alloys are likely to be used. If such information is not available, the selection should include sites typical of industrial, rural, and marine atmospheres. Test site characterization, if needed, shall be conducted in accordance with Practice G92.

4.2 Exposure racks should be located in cleared, well-drained areas such that the exposed specimens will be subjected to the full effects of the atmosphere at the location of the test site. Shadows of trees, buildings, or structures should not fall on the specimens, and local contamination of the atmosphere should be avoided, unless the specific influences of such conditions are intended to be assessed.

4.3 In special cases, the exposure racks may be partially sheltered to allow accumulation of corrosive materials from the

[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 Atmospheric Corrosion.

Current edition approved Nov. 1, 2015. Published December 2015. Originally approved in 1976. Last previous edition approved in 2010 as G50–10. DOI: 10.1520/G0050-10R15.

[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.

air but at the same time prevent washing by rain. If sheltering is used, its purpose and configuration should be described in detail.

4.4 If local pollution effects are to be investigated, the samples should be exposed at different distances from the source and at different elevations. Where it is particularly important to obtain corrosion rates involving a micro-environment, samples should be mounted directly on the structure involved. Suitable attachment must be devised for each case.

5. Exposure Racks and Frames

5.1 Test racks and frames should be constructed of a material that will remain intact for the entire proposed period of exposure. Galvanized pipe has been found adequate for rack construction in most environments (Note 1). Type 304 stainless steel is adequate as a frame material for all environments. For marine exposures, alloy 400 UNS No. N04400 or Type 316 stainless steel has also been successfully used. Aluminum (5052 and 6061-T6) and copper frames also have given satisfactory service in a wide range of environments. Care should be observed in the use of copper frames, as corrosion products splashed during rainfall might affect the corrosion of other metals such as aluminum or magnesium.

NOTE 1—If galvanized pipe is field-threaded, thread areas must be protected to ensure joint integrity for long exposure periods. In severe environments, additional coatings may be required to provide corrosion-free service.

5.2 Racks and frames also may be constructed of wood. Insulators may be attached to wooden frames with aluminum bronze, alloy 400, or stainless steel screws. In such a case, no wood sections should be used with dimensions less than 2 by 4 in. (50 by 100 mm), and at least two coats of an exterior grade paint or enamel over a suitable primer must be applied. Periodic maintenance will be required on all wood construction.

5.3 Solid, glazed, electrical insulator knobs should be used to hold the specimens on the frames, using stainless steel, alloy 400, aluminum, nylon, or bronze bolts and nuts. Specimens shall be mounted in the grooves of these insulators. In selecting fasteners for use on specific frame materials, care should be taken to avoid unfavorable galvanic relationships.

5.4 A suitable frame for mounting the insulators is shown in Fig. 1. This frame will accommodate 70 standard 4 by 6-in. (100 by 150-mm) specimens; other sizes can be mounted by rearranging the insulators in the holes provided. It is acceptable to slot the holes in the frames in such a manner that the mounting frames are adjustable for specimens of other sizes. This is a convenience when it is not possible to prepare specimens of a preplanned size, and it is often helpful in fitting the specimens snugly into the frames.

5.5 The racks should be designed to give exposure to as large an area of the underside of the specimens as possible. Structural members of the rack should not be located directly under the specimens where they would shelter the underside of the specimens.

5.6 As most published data on atmospheric corrosion of metals are based on an exposure angle of 30° from the horizontal, facing south, it is recommended that this angle be used. Racks should be designed so that the lowest specimens are at least 30 in. (760 mm) above the ground. See Notes 2 and 3.

NOTE 2—Maximum exposure to the sun may be obtained by exposing specimens facing south (for the northern hemisphere) at an angle equal to the latitude of the test site. Exposure at this angle will yield the lowest corrosion rates for most materials. Although these corrosion rates will change at other angles of exposure, the order of merit established for each material will be the same.

NOTE 3—In special instances, it may be desirable to orient racks and frames in the direction of a specific corrodent source, for example, the ocean, for marine environments. Also, this practice should not be construed as prohibiting special orientation of test frames for specific test purposes, but it is strongly suggested that in such cases testing also be done in accordance with this practice so that a basis point for comparison with available data is determined. Any special orientation or preferential source of corrosion should be specifically identified in the exposure site description.

5.7 A rack of the design and dimensions shown in Fig. 2 will give the correct exposure angle and can support the specimen frame described in 5.4.

5.8 The ground under the racks should be kept free of weeds, bushes, and debris. Organic herbicides, defoliants, or pesticides should not be used for this purpose.

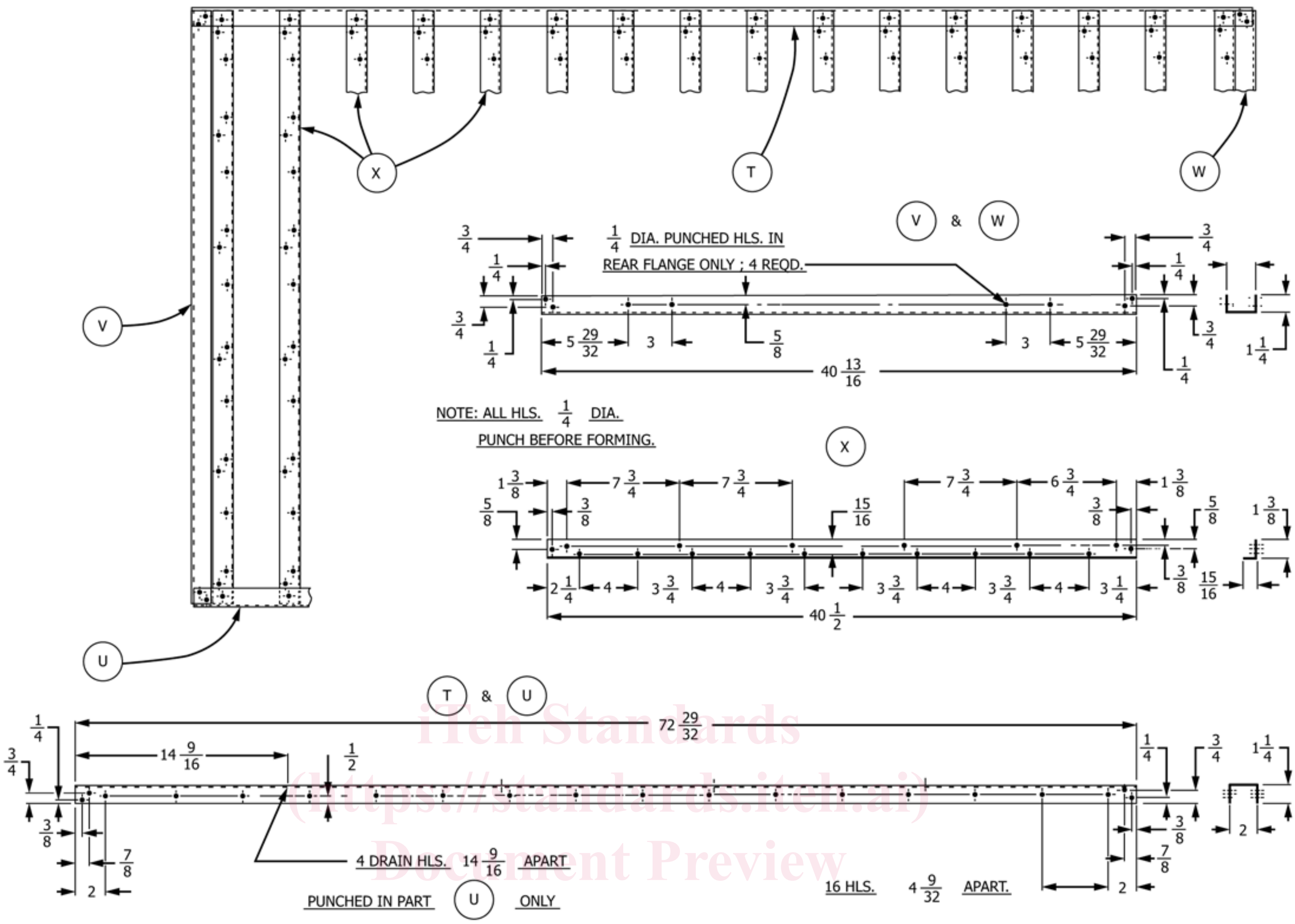
6. Test Specimens

6.1 When the material to be tested is in sheet form, a specimen size of 4 by 6 in. (100 by 150 mm) is appropriate. Specimens may be larger, for example, 4 by 8 in. (100 by 200 mm), to suit a particular test; however, the specimens preferably should not be smaller than 4 by 6 in.

6.2 To assure adequate rigidity of the specimens on the rack, a minimum thickness of 0.030 in. (0.75 mm) is suggested. It may be difficult to accommodate thicknesses greater than 0.250 in. (6.25 mm) in the insulator grooves. (Special deep-throated insulators can be obtained to accommodate thicker specimens, or the edges of thicker specimens can be machined to fit standard insulators.)

6.3 When it is desired to test samples of odd shapes, such as bolts, nuts, pipes, angles, assemblies, and structures, etc., a means of supporting them in the test racks must be devised. It is important that the specimens be electrically insulated from their respective supports and from each other to prevent unintentional galvanic corrosion. However, if desired, galvanic couples of dissimilar metals can be exposed on these frames. Efforts should be made to minimize crevices between specimens and support materials.

6.4 The total number of test specimens required should be determined from a knowledge of the duration of the test and the planned removals of the specimens for intermediate evaluations. Usually it should not be necessary to remove specimens prior to completing one year's exposure, unless specific data are required for corrosion occurring during earlier stages of exposure. For reliable results, sufficient specimens should be used for multiple removals at each exposure period. Triplicate specimens for each examination period will usually satisfy this



Metric Equivalents

in.	mm	in.	mm
¼	6.35	3¼	82.6
⅜	9.52	3¾	95.2
½	12.7	4	101.6
⅝	15.9	4 19/32	116.7
¾	19.1	5 29/32	150.0
⅞	22.2	6¾	171.4
15/16	23.8	7¾	196.9
1¼	31.8	14 9/16	369.9
1⅜	34.9	40½	1028.7
2	50.8	40 13/16	1036.6
2¼	57.2	72 29/32	1851.8
3	76.2		

All dimensions shown are outside dimensions and are in inches.

MK	Req.	Material	Description			
			Angles			
			Length	Leg		Leg
X	16	16 Ga. Stainless	40½	15/16		1⅜
			Channels			
			Length	Flange	Web	Flange
W	1	14 Ga. Stainless	40 13/16	1¼	2	1¼
V	1	14 Ga. Stainless	40 13/16	1¼	2	1¼
U	1	14 Ga. Stainless	72 29/32	1¼	2	1¼
T	1	14 Ga. Stainless	72 29/32	1¼	2	1¼

FIG. 1 Suitable Test Frame

requirement. A suggested suitable removal schedule is 1, 2, 4, 8, and 16 years. Removal schedules for tests of different periods of total exposure should be adjusted accordingly.

6.5 Included with each series of test specimens should be an appropriate number of control specimens, as defined in 3.2.

7. Preparation of Test Specimens

7.1 Specimens should be identified in a manner that will endure for the life of the test. A good method is the use of a series of edge notches or drilled holes in the body of the specimen arranged according to some desired code. Another method is to attach a stainless steel tag by means of an insulated cord and a suitably located hole. Numbers stamped on the back of the specimen and further protected by covering with a good grade of electrical tape is a suitable technique for short-term exposure tests. For materials that do not exhibit significant atmospheric corrosion (copper, aluminum, stainless steels, etc.), it is sufficient to stamp the identification on the face of the panel.

7.2 Oil, grease, and dirt should be removed by degreasing with a solvent cleaner or scrubbing, or both, to remove insoluble soils (see Practice G1). Any mill scale or rust should