Designation: G92 − 20

Standard Practice for Characterization of Atmospheric Test Sites[1]

This standard is issued under the fixed designation G92; 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 procedures for the characterization of atmospheric test sites. Continuous characterization can provide corrosion data, environmental data, or both which will signal changes in corrosivity of the atmospheric environment. This practice can also provide guidance for classification of future test sites.

1.2 Two methods are defined in this practice for the characterization of atmospheric test sites. The methods are identified as characterization Methods A and B. The preferred characterization technique would require using both Method A and B for concurrent data collection.

1.2.1 Method A is to be used when atmospheric corrosion is monitored on a continuing basis at a test site using specified materials and exposure configurations.

1.2.2 Method B is specified when atmospheric factors are monitored on a continuing basis.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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. Referenced Documents

2.1 *ASTM Standards:*[2]

A36/A36M Specification for Carbon Structural Steel
B6 Specification for Zinc
G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens
G50 Practice for Conducting Atmospheric Corrosion Tests on Metals
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

3. Summary of Methods

3.1 Characterization Method A is to be used when atmospheric corrosion data are to be obtained.

3.1.1 Corrosion tests to measure the corrosivity of the test site should follow the procedure established by Practice G50. Additional special instructions are identified in this procedure relating to types of materials for corrosion characterization tests, time of test exposure, positioning of test specimens, removal of test specimens and proper identification, cleaning practices, and reporting of data.

3.2 Characterization Method B is to be used when atmospheric climatological factors influencing the corrosion of metals are to be monitored.

3.2.1 Several atmospheric factors which have been identified as having significant bearing on the corrosion of metals include, but are not limited to, sulfur dioxide, chlorides, temperature, humidity, precipitation, time of wetness, and atmospheric particulate matter.

3.3 The preferred technique utilizes both Methods A and B for concurrent data to be collected.

3.3.1 Should either Method A or B be singled out as the primary technique to be used on a continuing basis, both should be used at some point in time to establish a data base. The availability of computerized weather stations greatly facilitates the collection of reliable atmospheric data.

4. Significance and Use

4.1 This practice gives suggested procedures for characterization of atmospheric test sites. It can be useful to researchers, manufacturers, engineering firms, architects, and construction contractors to provide corrosion and environmental data, materials selection information, and a materials storage practice.

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[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.

4.2 This practice does not give specific parameters for classifying the type of test site.

PROCEDURES

5. Method A

5.1 *Materials:*

5.1.1 The materials recommended for conducting atmospheric corrosion characterization studies are copper-bearing structural carbon steel (such as Specification A36/A36M with 0.2 % copper min) and high-purity zinc (Specification B6 high grade).

5.1.2 Materials recommended are the absolute minimum required to serve as a characterization base for test sites. Additional materials should be added to meet individual needs. Sufficient material should be obtained at the start to insure that an ample supply of the same heat is available to complete the characterization test. If tests are on-going and additional materials must be obtained, care should be taken in attempting to match material compositions.

5.1.3 Sufficient specimens should be prepared to comply with the specific criteria for the planned characterization test.

5.2 *Material Preparation:*

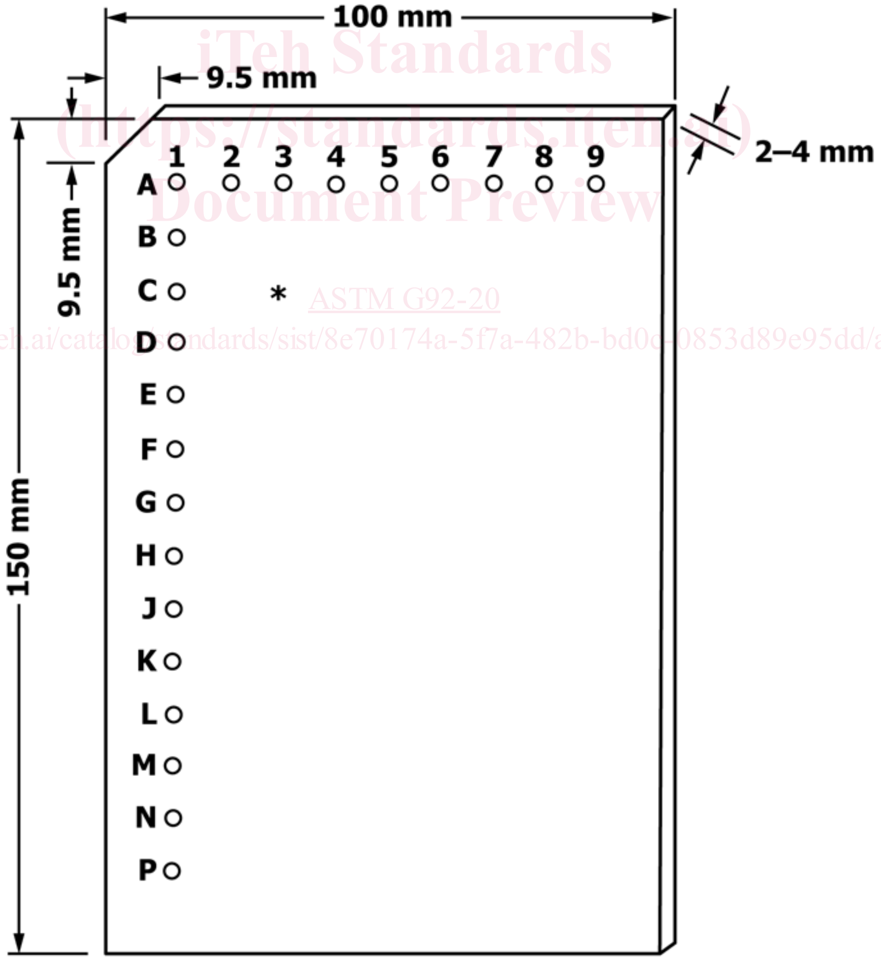
5.2.1 Atmospheric test specimens, as shown for example, in Fig. 1, shall be cut and finished in a manner that will not detrimentally affect the corrosion behavior of exposed edges.

NOTE 1—Shearing may not be practical for some material section thicknesses, and may introduce stresses and microcrevices that may accelerate edge attack if not further machined.

5.2.2 An identifying code should be assigned to each specimen. Locating a permanent code on each test specimen can be accomplished easily by using a code template (Fig. 1).

5.2.2.1 Pre-assignment of codes for a definite test period is suggested. After a temporary mark is placed on the specimen, a permanent drilled code (a series of 2.5 mm holes) should perforate the test specimen.

5.2.3 All test specimens of the same alloy should be cleaned by the same procedure to ensure a comparative surface finish following the guidance of Practice G1. The recommended practice for cleaning is (*a*) degrease and pickle, if necessary, to remove grease, mill scale, or other impurities; (*b*) scrub with pumice and only a natural fiber or synthetic fiber bristle brush



* Template contains 126 drilled holes

FIG. 1 Sample Atmospheric Specimen Drill Code Identification Template

TABLE 1 Sample Data Sheet for Atmospheric Corrosion Data

Test Site: Kure Beach (250 m lot) Latitude: 34° 00' N
Exposure Dates: 10/7/61 to 10/6/62 Longitude: 77° 55' W

Material	Code	Exposure Period (days)	Mass (g) Original	Mass (g) Final	Mass (g) Loss	Mass Loss Per Unit Area (mg/m^2)	Corrosion Rate (mm/y)
Cu-steel	A1-B2	365	196.583	187.332	9.251	2.86×10^5	0.0365
Zinc	A2-B2	365	67.521	66.938	0.583	1.84×10^4	0.0026

Test Method Documentation

	Steel	Zinc
1. Composition (weight %)	0.15 C, 1.0 Mn, 0.01 P, 0.027 S, 0.24 Si, 0.21 Cu, 0.05 Ni, 0.03 Cr, Balance Fe	0.01 Cu, 0.012 Cd, 0.03 Pb, 0.02 Fe, Balance Zn
2. Density (g/cm^3)	7.85 g/cm^3	7.13 g/cm^3
3. Dimensions (mm)	100 mm × 150 mm × 2.00 mm	100 mm × 150 mm × 2.00 mm
4. Exposed area (cm^2)	322.9 cm^2	317.7 cm^2

until free of water-break; (*c*) dry with towels; and (*d*) place in a desiccator for 2 h before weighing.

5.2.4 Specimens should be weighed (±1.0 mg) and original mass recorded on a data sheet (Table 1). Specific information, such as nominal composition, density, and exposed area should also be recorded.

5.2.5 Specimens should be stored in a desiccator or sealed in airtight storage bags until the time of exposure.

5.3 *Exposure of Test Specimens:*

5.3.1 The frequency at which test specimens should be exposed at a test site is dictated by the specific needs for data.

5.3.2 Triplicate specimens of each material should be exposed for each test period.

5.3.3 An exposure period of one year is suggested as a minimum, multiple periods should be considered, for example, 3, 6, and 12 months; 1 and 2 years or 1, 2, and 4 years. Shorter test periods may be necessary where corrosion is severe and longer test periods where corrosion is less severe.

5.3.3.1 Consideration should also be given to use of test periods which could allow definition of changes in environment corrosivity occurring during an overall longer term evaluation period. For example, exposure of specimens on the schedule, 0 to 3, 3 to 6, 6 to 9, 9 to 12, 0 to 6, 6 to 12, and 0 to 12 months, would allow some assessment of relative changes in corrosivity at a test site during a one year period. While this is a relatively extensive exposure frequency, it may prove useful in some instances.

5.3.4 A standard atmospheric exposure test rack (see Practice G50), or other appropriate devices, should be positioned at 30° to the horizontal facing the Equator in accordance with Practice G50. The test specimens should be mounted with porcelain insulators or other appropriate insulating materials.

5.3.5 Atmospheric corrosivity test specimens designated for specific exposure periods should be positioned at approximately the same elevation on the test rack.

5.3.6 It is suggested that the general weather conditions be documented at the time the specimens are exposed, for example, clear, cloudy, or rain.[3]

5.3.6.1 Initial weather conditions at time of exposure of test specimens may have an effect on long term corrosion behavior (**1**).[4]

5.4 *Removals and Reporting:*

5.4.1 After the predetermined exposure period is completed (for example, one year), the specimens should be removed and placed in pre-labeled envelopes. Observations or photographs needed to document appearance can be made at this time or after the specimens reach the laboratory or other process area. Wet specimens should be carefully dried if extended storage (more than 24 h) is anticipated before cleaning.

5.4.2 The test specimens being removed should be identified as to exposure location, exposure period, specimen code, original mass, composition, original dimensions, and exposed area and information documented as shown in Table 1.

5.4.3 As each specimen is clearly identified and observations documented, it can be cleaned, in accordance with Practice G1. Specimens should then be dried and placed in a desiccator for 2 h or more before final weighing.

5.4.4 Each specimen should then be weighed to the nearest milligram and the mass recorded. Also a description of the type of corrosion attack should be recorded, for example, pitting (depth).

5.4.5 After the mass loss has been calculated, a mass loss per unit area (mg/m^2) and corrosion rate (mm/y) can be calculated using the following equations (see Practice G1 for further guidance).

$$M_a = \frac{M}{A} \tag{1}$$

where:

M_a = mass loss per unit area, milligrams per square metre
M = mass loss, milligrams, and
A = exposed surface area, metres squared

$$C = \frac{(8.76 \times 10^4) M_1}{a \times t \times d} \tag{2}$$

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[3] Also available are data from the National Climate Data Center, NOAA, Ashville, NC.

[4] The boldface numbers in parentheses refer to a list of references at the end of this standard.