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Standard Guide for Applying Statistics to Analysis of Corrosion Data¹

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ε¹ NOTE—Section 10 was added editorially in October 1999.

1. Scope

1.1 This guide presents briefly some generally accepted methods of statistical analyses which are useful in the interpretation of corrosion test results.

1.2 This guide does not cover detailed calculations and methods, but rather covers a range of approaches which have found application in corrosion testing.

1.3 Only those statistical methods that have found wide acceptance in corrosion testing have been considered in this guide.

2. Referenced Documents

2.1 ASTM Standards:

E 178 Practice for Dealing with Outlying Observations²

E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)²

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method²

G 46 Guide for Examination and Evaluation of Pitting Corrosion³

3. Significance and Use

3.1 Corrosion test results often show more scatter than many other types of tests because of a variety of factors, including the fact that minor impurities often play a decisive role in controlling corrosion rates. Statistical analysis can be very helpful in allowing investigators to interpret such results, especially in determining when test results differ from one another significantly. This can be a difficult task when a variety of materials are under test, but statistical methods provide a rational approach to this problem.

3.2 Modern data reduction programs in combination with computers have allowed sophisticated statistical analyses on

data sets with relative ease. This capability permits investigators to determine if associations exist between many variables and, if so, to develop quantitative expressions relating the variables.

3.3 Statistical evaluation is a necessary step in the analysis of results from any procedure which provides quantitative information. This analysis allows confidence intervals to be estimated from the measured results.

4. Errors

4.1 *Distributions*—In the measurement of values associated with the corrosion of metals, a variety of factors act to produce measured values that deviate from expected values for the conditions that are present. Usually the factors which contribute to the error of measured values act in a more or less random way so that the average of several values approximates the expected value better than a single measurement. The pattern in which data are scattered is called its distribution, and a variety of distributions are seen in corrosion work.

4.2 *Histograms*—A bar graph called a histogram may be used to display the scatter of the data. A histogram is constructed by dividing the range of data values into equal intervals on the abscissa axis and then placing a bar over each interval of a height equal to the number of data points within that interval. The number of intervals should be few enough so that almost all intervals contain at least three points, however there should be a sufficient number of intervals to facilitate visualization of the shape and symmetry of the bar heights. Twenty intervals are usually recommended for a histogram. Because so many points are required to construct a histogram, it is unusual to find data sets in corrosion work that lend themselves to this type of analysis.

4.3 *Normal Distribution*—Many statistical techniques are based on the normal distribution. This distribution is bell-shaped and symmetrical. Use of analysis techniques developed for the normal distribution on data distributed in another manner can lead to grossly erroneous conclusions. Thus, before attempting data analysis, the data should either be verified as being scattered like a normal distribution, or a transformation should be used to obtain a data set which is approximately

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ *Annual Book of ASTM Standards*, Vol 03.02.