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**An appraisal of the problems
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for atmospheric corrosion**

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Foreword

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An appraisal of the problems of accelerated testing for atmospheric corrosion

Foreword for Japanese Industrial Standard

This Japanese Industrial Standard has been prepared based on the first edition issued in 1971 of IEC 355 (An appraisal of the problems of accelerated testing for atmospheric corrosion) without changing the technical contents.

"Informative reference" with dotted underline is not included in the original International Standard.

1. Introduction

This Standard deals with general information on accelerated tests for atmospheric corrosion.

Subsequent clauses cover different applications of accelerated tests as follows :

- Clause 2 : Tests to predict the performance of a specimen under conditions of use.
- Clause 3 : Tests to check the quality and homogeneity of a special material.
- Clause 4 : Tests to determine the influence of different materials on each other.
- Clause 5 : Tests to check the functioning of equipment or components under corrosive conditions.
- Clause 6 gives some information on the standardizing of accelerated tests.
- Clause 7 is a generally worded section on conclusions to be drawn from the information available.

2. Tests to predict the performance of a specimen under conditions of use

An ideal general corrosion test could be defined as :

A test that gives in a short time, preferably within a few hours but at least within a few days or weeks, a rating of the behaviour of a material, a component or an equipment that can be correlated with its performance under conditions of use over several years.

Such an ideal test is not possible for several reasons :

- conditions of use are not defined and vary over a very wide range ;
- in order to accelerate corrosion phenomena, certain corrosive conditions have to be intensified with the danger that the mechanism of the attack and the appearance of the corrosion products may be changed ;
- different materials react very differently to intensifying of corrosive factors.

2.1 Conditions of use

The most important factors affecting the corrosion under conditions of use are :

- a) climate, for example marine, rural, urban, industrial and tropical climates, or combinations thereof ;

- b) irregular variations in each climate from place to place and also at the same place, not only with the seasons but from year to year, from day to day and even from hour to hour ;
- c) exposure conditions, for example, indoors, outdoors and, if outdoors, under shelter or in the open ;
- d) atmospheric pollution, for example, dust and soot particles and corrosive gases other than those specific to the particular climate ;
- e) position of the test specimen, for example the attitude of the surface : horizontal, vertical or sloping ; exposure to the sun ; exposure to or shelter from rain. It is possible for one surface of a material to be much more corroded than another surface of the same material in the same equipment.

With these variations in conditions of use, it is clearly not possible to have one general accelerated corrosion test for predicting the behaviour of a component or equipment under *conditions of use*. One test, with variation of the severity produced by varying the duration of the test, e.g. one day for a rural atmosphere and four days for a marine atmosphere, etc., gives no real information on the behaviour that can be expected in different types of climate, because the corrosive factors in these climates are different.

A better approximation may be obtained by using different tests for different climates, for example, salt spray for marine climates or humid air with sulphur dioxide for industrial climates.

Unfortunately, this will give only an alleviation of the problem, due to the factors a) to e).

These different general purpose tests are still very dangerous in their interpretation and may result in many misleading conclusions.

2.2 Methods to accelerate the corrosion process

To get the desired information in a short time, the corrosion process must be accelerated. This is done by changing some of the conditions of exposure. The most usual changes are :

- increasing the temperature ;
- increasing the relative humidity ;
- increasing the extent of condensation ;
- increasing the concentration of corrosive substances ;
- increasing the duty cycle of corrosive conditions ;
- application of voltage or current ;
- mechanical stress ;
- cyclic variations of temperature.

Note. — Information could be obtained more quickly if the sensitivity of the evaluation of the corrosion could be improved. As this is, at present, very difficult, acceleration of the corrosion process is usually necessary.

2.2.1 Temperature

In general, a chemical reaction is accelerated by a factor of 2 to 3 for a temperature rise of 10 °C, provided that the increased temperature does not initiate or accelerate some different reaction. Unfortunately, many factors, which influence the corrosion rate, may change with the temperature. A few examples are :

- a) the solubility of gases in water usually decreases with rising temperature. Under special conditions of condensation, this may slow down the corrosion rate ;