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(IEC 68-2-49 : 1983)

**Basic environmental testing
procedures Part 2 : Tests
Guidance to Test Kc :
Sulphur dioxide test for
contacts and connections**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

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Basic environmental testing procedures

Part 2: Tests — Guidance to Test Kc:

Sulphur dioxide test for contacts and connections

Foreword for Japanese Industrial Standard

This Japanese Industrial Standard has been prepared based on the 1st edition issued in 1983 of IEC 68-2-49 [Basic environmental testing procedures, Part 2 : Tests—Guidance to Test Kc : Sulphur dioxide test for contacts and connections] without changing the technical contents.

Furthermore, matters that are indicated by underlines (dotted line) or solid side lines do not appear in the original International Standard.

1. Introduction

Satisfactory performance during the desired lifetime of contacts and connections depends on many parameters, some of them determined by their design (type, materials, forces, etc.) and others by the environment in which they have to function. Concerning the effects of the environment, special attention shall be paid to the polluting substances contained — usually in very small amounts — in the atmosphere. JIS C 0090 : 1993 Basic Environmental Testing Procedures, Part 2: Tests, Test Kc: Sulphur Dioxide Test for Contacts and Connections, relates to one of the most important pollutants found especially in urban and industrial atmospheres, namely, sulphur dioxide (SO_2).

Informative reference: JIS C 0090-1993 is identical to IEC 68-2-42 : 1982 [Basic environmental testing procedures, Part 2 : Tests - Test Kc: Sulphur dioxide test for contacts and connections].

2. Sulphur dioxide in the atmosphere

Atmospheric corrosion of metals is usually brought about by humidity and by pollution products in the atmosphere. One of the main sources of pollution is the combustion products of fossil fuels. Of these combustion products, the corrosive constituent present in the largest quantity is sulphur dioxide (SO_2); sulphur trioxide (SO_3), oxides of nitrogen and chloride have also been detected but in much lower concentrations.

Tables I and II show that the concentration of sulphur dioxide in the free atmosphere in urban and industrial locations is generally in the range of 1 to 100×10^{-9} parts by volume, but in local areas may reach peaks of 10^{-6} parts by volume or more.

In a humid atmosphere, sulphur dioxide will corrode all except precious metals and silver and can have a pronounced effect on the performance of temporary contacts (3.1) In extreme cases, contacts can go open-circuit as a result of corrosion products building up and preventing a metal-to-metal contact.

3. Object and scope of the test

3.1 *Types of contacts and connections*

As this test is specifically intended for certain types of contacts and connections (other than those of the welded or soldered type), a short description of these types of contacts and connections is considered to be useful.

Contacts and connections may be divided into two types: permanent or temporary. In both cases, metal surfaces are held together by an external force.

In the case of permanent connections, the force is very great and will usually cause permanent deformation of the metals and it is possible that a form of local welding takes place. Such connections are not intended to be made and broken during their lifetime. Examples of permanent connections are crimp and wrap joints.

With temporary connections, the force holding the metals in contact is by comparison light and they are of course designed to be made and broken possibly very many times during their lifetime. Examples of temporary connections are: connectors, switches and relays. In temporary connections the areas of metal which make contact with each other are in some cases referred to as contacts.

The contacts or contact areas in temporary connections are made of various metals according to duty and application.

Most metals – with the exception of precious metals – suffer from atmospheric corrosion. When contact materials corrode, contact resistance increases. The extensive use of precious metal contacts would be costly, so it is common in many applications to use precious metal alloys or coatings of precious metal or alloys over base metals for contact materials.

In the case of permanent joints, it is not normal to use precious metals and some general surface corrosion by sulphur dioxide must be expected. But, in a properly designed and made crimp or wire wrap joint, corrosion does not occur between the contact surfaces due to the cold weld and high pressure. However, in joints that are poorly made or weakened, for example as a result of thermal cycling, corrosive gas will penetrate into contact areas with a resultant increase in contact resistance.

3.2 *Object of the test*

The test is used to study the following:

- a) The effect on contact resistance of precious metal* or precious metal-coated contacts and connections by exposure to atmosphere polluted by sulphur dioxide.
- b) The effectiveness of crimp or wire wrap joints.

* For the purpose of this test, silver and some of its alloys are not considered as precious metal because under the test conditions, corrosion would be expected.

The test may be used as an acceptance test in type approval of components or equipment from a supplier or as a comparison in the choice of materials, processes or designs (see Clause 8). In acceptance testing, the sulphur dioxide test is usually preceded by a suitable ageing test (e.g. by a mechanical endurance test* to impart wear to the contact surface in case a) or by heat cycling in case b)). The principal criterion of performance is the rise of contact resistance which may occur as a result of exposure to the sulphur dioxide atmosphere.

* As normally used in the mechanical endurance test, but for acceptance testing probably with a lower number of operations or a shorter ageing time than used for type testing.

4. Parameters of the test

The major parameters of the test are:

- concentration of sulphur dioxide;
- relative humidity;
- temperature;
- flow rate;
- test duration.

4.1 *Concentration of sulphur dioxide*

From the many values proposed, a concentration of 25×10^{-6} parts by volume has been chosen after much experimenting and after many years of trials. It is high enough to give a reasonable level of acceleration to the test and yet not so high that it will cause the corrosive mechanism to depart from that found in service.

Small amounts of sulphur trioxide have a much lower degree of importance.

It is important to ascertain that stable conditions of sulphur dioxide concentration reign in the test chamber. Periodic checks during the entire period are also necessary. Any established method for the determination of sulphur dioxide may be used provided that it has been proved able to measure the specified concentration with sufficient accuracy.