

Basic environmental testing procedures —

Part 2.2: Guidance —

Test Kd: Guidance on Test Kd: Hydrogen sulphide test for contacts and connections

(This Part should be read in conjunction with Part 1.1 *General and guidance*)

UDC 621.3.002.6.001.4:620.169.1:[621.315.68:546.221.1]

This British Standard, having been prepared under the direction of the General Electrotechnical Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 January 1984

© BSI 11-1999

The Committees responsible for this British Standard are shown in Part 1.1. The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Biodeterioration Society
Institution of Metallurgists

The following BSI references relate to the work on this standard:
Committee reference GEL/15
Draft for comment 82/32339 DC

ISBN 0 580 13722 8

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

	Page
National foreword	ii
1 Introduction	1
2 Hydrogen sulphide in the atmosphere	1
3 Object and scope of the test	1
4 Parameters of the test	2
5 Severity of the test	3
6 Evaluation of results	4
7 Notes for the user of the test and for authors of specifications	4
Figure 1 — Tarnish kinetics of silver at 75 % r.h. compared with field test data	6
Table I — An example of the statistical distribution of hydrogen sulphide measurements	4
Table II — Representative concentrations of hydrogen sulphide (H ₂ S) measured at a range of sites	5
Publications referred to	Inside back cover

National foreword

This British Standard has been prepared under the direction of the General Electrotechnical Engineering Standards Committee. It is identical with IEC Publication 68-2-46:1982 “*Basic environmental testing procedures, Part 2: Tests — Guidance to Test Kd: Hydrogen sulphide test for contacts and connections*”, published by the International Electrotechnical Commission (IEC). With certain exceptions (e.g. IEC 68-2-42 and IEC 68-2-43), all Parts of IEC Publication 68 are endorsed by CENELEC Harmonization Document (HD) 323.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following. The word “must” is not used in British Standards and, for the purposes of this standard, “must” should be read as “should” wherever it appears.

Cross-references

International Standard ^a	Corresponding British Standard
IEC 68-2-42:1976	BS 2011 <i>Basic environmental testing procedures</i> Part 2.1Kc:1977 <i>Test Kc. Sulphur dioxide test for contacts and connections</i> (Identical)

^a Undated in the text.

There is no corresponding British Standard for IEC Publication 355. The Technical Committee has reviewed the provisions of IEC Publication 355 and has decided that they are acceptable for use in conjunction with this standard.

Additional information. In 3.1, in the fifth paragraph, where reference is made to “Most metals — with the exception of precious metals”, “precious metals” should be understood as referring to precious metals excluding silver and its alloys, as in BS 2011-2.1Kc.

In 4.6, the reference to “an acrylic resin test cabinet” should be read as “a test cabinet made from acrylic resin”.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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 must be paid to the polluting substances contained—usually in very small amounts—in the atmosphere.

Silver and some of its alloys are peculiarly susceptible to tarnishing by the minute quantities of hydrogen sulphide that occur in many environments. The tarnish product is dark in colour and consists largely of β -silver sulphide.

Separable electrical connections employing these metals as contact materials may therefore suffer from increased contact resistance and contact noise as a result.

2 Hydrogen sulphide in the atmosphere

Hydrogen sulphide is evolved by bacterial reduction of sulphates in vegetation, soil, stagnant water and animal waste. In the atmosphere it is readily oxidized to sulphur dioxide, which is brought to the ground by rain. Where the soil is aerobic, certain bacteria turn the sulphur dioxide to sulphates. When or where rotting organic matter generates anaerobic conditions, sulphate reducing bacteria complete the cycle and turn the sulphate to hydrogen sulphide, which is the principal natural sulphur input in the atmosphere. It is therefore a widespread pollutant in air.

Sulphur dioxide will accumulate in the atmosphere when it is not rinsed by rain. In urban areas burning of fossil fuels emits sulphur dioxide into the atmosphere. The content can be 10 times to 1 000 times that of hydrogen sulphide and becomes the dominant cause of corrosion. In equal concentration, hydrogen sulphide is the more corrosive of the two, particularly on silver and copper. (See IEC Publication 68-2-42: Part 2: Tests—Test Kc: Sulphur Dioxide Test for Contacts and Connections.)

Although the major input to the sulphur cycle is by hydrogen sulphide through natural processes, industrial processes also play a part. Oil refineries, chemical plants and gas works are all possible sources. Atmospheric concentrations of 1 ppb to 30 ppb (parts in 10^9 by volume) are commonly reported. At many sites peak values exceed this, and much higher concentrations are found close to sources. Table I, page 4, illustrates a typical statistical distribution of measurements of hydrogen sulphide concentration. Table II, page 5, lists representative concentrations at a range of sites. These levels are sufficient to account for the natural tarnishing of silver. Other sulphurous pollutants are much less important.

Sulphur dioxide has little effect on silver unless the concentration and humidity are high, and then it produces a tarnish product that is rarely found in practice. The two commonest organic sulphurous pollutants: methyl mercaptan and carbon disulphide do not tarnish silver at all. Some organic sulphur derivatives do tarnish silver, as does elemental sulphur vapour, but these materials probably occur only in a small minority of environments.

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 and could be described as 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.