AS 60068.2.46—2004
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AS 60068.2.46—2004

Australian Standard™

Environmental testing

Part 2.46: Tests—Guidance to test Kd: Hydrogen sulphide test for contacts and connections

STANDARDS
AUSTRALIA

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- Australian Chamber of Commerce and Industry
- Australian Electrical and Electronic Manufacturers Association
- Electrical Compliance Testing Association
- Electrical Regulatory Authorities Council
- Energy Supply Association of Australia
- Testing Interests (Australia)

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PREFACE

This Standard was prepared by the Standards Australia Committee EL-026, Protective Enclosures and Environmental Testing for Electrical/Electronic Equipment.

The objective of this Standard is to provide the electrotechnology industry with a complete set of environmental test procedures published as a series under AS 60068 *Environmental testing*. This Standard is Part 2.46 of that series.

This Standard is identical with, and has been reproduced from, IEC 60068-2-46:1982, *Environmental testing* – Part 2-46: *Tests—Guidance to test Kd: Hydrogen sulphide test for contacts and connections*.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text 'this international standard' should read 'this Australian Standard'.

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In this Standard, the following print types are used:

- requirements proper: in arial type;
- *test specifications: in italic type;*
- explanatory matter: in smaller arial type.

Any international Standard referenced should be replaced by an equivalent Australian Standard where one is available. The availability of equivalent Australian Standards can be determined either from the Standards Australia catalogue or from the Standards Australia website (www.standards.com.au).

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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 1000 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 60068-2-42: 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 illustrates a typical statistical distribution of measurements of hydrogen sulphide concentration. Table II 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.