

Guide for

Prevention of corrosion of metals caused by vapours from organic materials

ICS 55.020, 77.060

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Packaging and Freight Containers Standards Policy Committee (PKM/-) to Technical Committee PKM/583, upon which the following bodies were represented:

- British Rubber Manufacturers' Association
- Institute of Marine Engineers
- Institute of Packaging
- Institute of Petroleum
- Institution of Mechanical Engineers
- Ministry of Defence

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Foreword

This British Standard has been prepared under the direction of the Packaging and Freight Containers Standards Policy Committee at the request of the Ministry of Defence.

BS 7195:1989+A1:2010 supersedes BS 7195:1989, which is withdrawn.

The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tags **A1** **A1**. Minor editorial changes are not tagged.

Amendment A1 introduces the following principal change:

- the addition of guidance on the prevention of toxic products released by cadmium corrosion.

This British Standard is based on Def Stan 03-13/1 and deals with a source of corrosion not covered by BS 1133-6. The information contained in this guide is based upon past experience of, and research into, corrosion problems which have arisen in confined spaces but does not cover all aspects of this type of corrosion.

Users of this standard involved with Ministry of Defence contracts should seek advice from the appropriate Research and Development Establishment or the Directorate of Quality Assurance/Technical Support (DQA/TS), Materials Centre, Royal Arsenal East, Woolwich, London, SE18 6TD.

Specifications for protective schemes approved for use in connection with Ministry of Defence contracts are listed in Appendix A.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot 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 10, 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 Scope

This British Standard gives guidance to those engaged in design, production, quality assurance and packaging on:

- a) the tendency of some organic materials to emit corrosive or potentially corrosive vapours;
- b) the liability of certain metals to be corroded by these vapours;
- c) the measures which can be taken to reduce or eliminate the corrosion;
- A1** d) the prevention of toxic corrosion products. **A1**

This British Standard relates to the general surface corrosion of parts in use as well as in store. It does not cover the more complex corrosion reactions such as stress corrosion, contact corrosion, bi-metallic corrosion and organic vapour corrosion caused by thermal decomposition, for example thermal decomposition of polyvinyl chloride at 75 °C.

NOTE The titles of the publications referred to in this British Standard are listed on the inside back cover.

2 General

2.1 Occurrence

A1 2.1.1 General. **A1**

Vapour corrosion occurs when metallic parts are confined with water vapour and constructional and coating materials or cleaning process residues which emit corrosive volatile compounds or compounds which can oxidize or decompose to form corrosive compounds. The volatile compounds are frequently lower aliphatic aldehydes and acids and such materials attack metals and alloys at varying rates. The metals and alloys in common use can be divided into groups according to the degree of attack which may occur. Expert advice should be sought on alloys not included in the following groups.

- a) Group 1: severe attack
 - Cadmium
 - Carbon steels
 - Lead and lead alloys
 - Zinc and zinc alloys
 - Magnesium and magnesium alloys
- b) Group 2: moderate attack
 - Copper and copper alloys
- c) Group 3: very slight attack
 - Aluminium and aluminium alloys
 - Nickel and nickel alloys
- d) Group 4: resistant materials
 - Austenitic stainless steel
 - Chromium
 - Gold
 - Molybdenum
 - Silver

Tin

Titanium and titanium alloys

NOTE 1 Group 4 materials may not be completely resistant but for all practical purposes such attack that occurs is considered insignificant.

NOTE 2 The above classifications do not refer to corrosion caused by vapours of organic bases and inorganic acids and bases. In cases where emission of these vapours may be expected (see Table 1) expert advice should be sought.

A1 Text deleted. **A1**

A1 2.1.2 Cadmium. Due to the extreme toxicity of cadmium corrosion products, where cadmium is present, the use of wood or paper and board packaging is not permitted. Where it is not possible to separate wood (or paper and board) and cadmium, specific permission should be obtained from the customer and special precautions should be employed to protect both the component and personnel handling the product.

NOTE For the purposes of this British Standard, the terms paper and board only refer to those materials which have origins from or which have been derived from wood. Plastic paper and plastic board are not deleterious to susceptible metals and as such are not included in this standard. **A1**

2.2 Conditions for the development of vapour corrosion

2.2.1 General. Vapour corrosion depends primarily on the concentration of the corrosive vapours and the relative humidity and temperature of the air space surrounding the metal surface. Factors determining the severity of corrosion are described in 2.2.2 to 2.2.6.

2.2.2 Nature of the organic substance present and the vapours emitted. Materials known to release corrosive or potentially corrosive vapours at normal pressures are listed in Table 1. The vapours emitted are frequently lower fatty acids, especially formic and acetic acids and their aldehydes which in contact with some metals are oxidized to the corresponding fatty acids. Very low concentrations of these compounds in the air space, e.g. 1 p.p.m. by volume, can be extremely corrosive to some metals in moist atmospheres. Other corrosive vapours include hydrochloric acid, hydrogen sulphide, sulphur dioxide, phenols, amines and ammonia. Low atmospheric pressures may promote the emission of vapours.

2.2.3 Past history of the emitting substance. The liability of substances to emit corrosive or potentially corrosive vapour depends on their composition and in some cases on their age and the processing treatment they may have received, e.g. kiln drying of wood as opposed to natural seasoning and the undercuring of certain thermosetting resins may promote the emission of corrosive vapour.