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Intumescent paint for aerospace purposes — Specification

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Committees responsible for this British Standard

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British Coatings Federation Ltd.

Ministry of Defence

National Centre of Tribology

Oil and Colour Chemists Association

Society of British Aerospace Companies

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Foreword

This British Standard has been prepared by Technical Committee ACE/44 and is one of a series for paints and varnishes suitable for aerospace purposes. It covers the specification of an intumescent paint for use on ferrous and non-ferrous metals, selected composites and wood.

It has been assumed in the drafting of this British Standard that execution of its provisions is entrusted to appropriately qualified and experienced people.

WARNING. This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

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 does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises of a front cover, an inside front cover, pages i and ii, pages 1 to 7 and a back cover.

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1 Scope

This British Standard specifies requirements for the materials and performance of an ambient cure intumescent paint suitable for use in the aerospace industry, which will produce a substantial layer of protective foam when exposed to fire.

NOTE This product can produce toxic gases on exposure to fire, and therefore is not suitable for use in interior cabin areas.

Type approval requirements are provided in Annex A.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 2015, *Glossary of paint and related terms.*

BS EN 23270/ISO 3270, *Specification for temperatures and humidities for conditioning and testing paints, varnishes and their raw materials.*

BE EN 29117/ISO 9117, *Methods of tests for paints — Tests associated with paint film formation — Paints and varnishes — Determination of through-dry state and through dry time — Method of test.*

BS EN ISO 1513/BS 3900-A2, *Paints and varnishes — Examination and preparation of samples for testing.*

BS EN ISO 1514:1997/BS 3900-A3:1997, *Paints and varnishes — Standard panels for testing.*

BS EN ISO 1517/BS 3900-C2, *Paints and varnishes — Surface-drying test — Ballotini method.*

BS EN ISO 2431/BS 3900-A6, *Paints and varnishes — Method of determination of flow time by use of flow cups.*

BS EN ISO 2812-1/BS 3900-G5, *Paints and varnishes — Determination of resistance to liquids — Part 1: General methods.*

BS EN ISO 3668/BS 3900-D1, *Paints and varnishes — Visual comparison of the colour of paints.*

BS EN ISO 3696:1995, *Water for analytical laboratory use — Specification and test methods.*

BS EN ISO 11890-1:2000/BS 3900-A23:2000, *Paints and varnishes — Determination of volatile organic compound (VOC) content — Part 1: Difference method.*

BS EN ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling.*

BS L 163, *Specification for sheet and strip of aluminium-coated aluminium-copper-magnesium-silicon-manganese alloy (solution treated, cold worked for flattening and aged at room temperature) (Cu 4.4, Mg 0.5, Si 0.8, Mn 0.8).*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 2015 and the following apply.

3.1
char
scorched substance

3.2
intumescent
foaming

4 Materials

4.1 Composition

The paint shall consist of a pigmented resin base with suitable intumescent ingredient and a curing agent. The base and curing agent shall be mixed in specified proportions by volume and thinned as necessary with the appropriate thinners as recommended by the manufacturer.

The system shall also contain an ambient cure seal coat, if and when required.

5 Performance

5.1 General

5.1.1 Test panels shall be prepared and coated as specified in Annex B.

5.1.2 Unless otherwise specified, all tests shall be carried out in temperature and relative humidity conditions conforming to BS EN 23270.

5.2 Tests on liquid paint

The paint shall be tested in accordance with Table 1.

5.3 Tests on the dry film

The dried paint film shall be tested in accordance with Table 2.

6 Batch inspection

Before despatch, a representative sample of each batch of material shall be taken in accordance with BS EN ISO 15528. It shall be tested to conform to tests 1, 5 and 6 of Table 1 and, when prepared in accordance with Annex B, the scheme shall conform to tests 1 to 6 of Table 2.

NOTE Samples of material and ingredients may be inspected at any stage of manufacture, and from any portion of the batch.

7 Marking

Each container shall be legibly and durably marked with at least the following:

a) a description of the material;

b) the number and date of this British Standard, i.e. BS X 37:2004;

c) the manufacturer's name and recognized trade mark;

d) the batch number;

e) the date of manufacture;

f) mixing and thinning instructions.

NOTE This is in addition to any statutory requirements.

Table 1 — Tests on liquid paint

Test	Test panel, preparation and paint system	Conditions	Test method	Requirement
1) Condition	—	Components in their original or laboratory containers	BS EN ISO 1513	Shall be free from extraneous matter and shall show no skinning, gelling, hard settlement or other defect that might prevent satisfactory application of a defect-free film
2) Volatile organic compound (VOC) content	—	When prepared for application as specified in **B.2.1**	BS EN ISO 11890-1:2000, Method 1	Shall be less than or equal to the reference value[a]
3) Shelf life	—	After 12 months at 5 °C to 35 °C components in their original containers.	Tests 1), 5) and 6) of this table	Shall conform to the requirements
4) Pot life	—	Eight hours after preparation of a 1 000 ml sample[b]	BS EN ISO 2431	Viscosity shall not increase by more than a factor of two from the initial value, unless otherwise specified by the purchaser
5) Application	**B.1**, **B.2.1** to **B.2.4**	24 h after application	Visual examination with normal corrected vision	Paint film shall show an opaque even finish, free from runs, sags wrinkling, pin-holing or other defect
6) Drying time	**B.1**, **B.2.1** to **B.2.4**	After application	BS EN ISO 1517 BS EN 29117	Surface dry ≤ 1 h Through dry ≥ 24 h

[a] The reference value shall be established during type approval unless agreed otherwise between manufacturer and purchaser (see Annex A).
[b] For batch inspections, a sample size of 200 ml shall be tested.

Table 2 — Tests on the dry film

Test	Test panel, preparation and paint system	Conditions	Test method	Requirement
1) Colour	**B.1**, **B.2.1**, **B.2.2**		BS 3900-D1	As agreed between manufacturer and purchaser
2) Resistance to thermal exposure	**B.1**, **B.2**	1 000 h at 150 °C	Visual examination with normal corrected vision	No intumescent action occurring and shall still pass the requirements of test 4
3) Fluid resistance	**B.1**, **B.2**, **B.3**	Using tri-*n*-butyl-phosphate at a temperature of 70 °C and immersing the whole panel for a period of three hours minimum, on removal, the panel shall be left for 30 min minimum, wiped clean with a lint free cloth, soaked in a 75/25 v/v mixture of white spirit and xylene, left for one hour and then visually examined	BS EN ISO 2812-1	To be done after dry air ageing and exposure to tri-*n*-butyl phosphate. The film shall show no signs of softening, lifting or blistering. An intumescent test (test 4) shall also be carried out.
4) Intumescent test	**B.1**, **B.2**, **B.3**	Four panels, tested according to Annex C		A minimum of four coated test panels shall be tested and the degree of intumescence (I) shall be ≥ 50 for each test panel[a]
5) Thermal conductivity	**B.1**, **B.2**, **B.3**	Annex C		Temperature ≤ 380 °C using an aluminium panel of thickness 1.2 mm
6) Water resistance		Immerse for 24 h duration at (40 ± 2) °C in water conforming to at least Grade 3 of BS EN ISO 3696:1995.	BS EN ISO 2812-1	After removal from test, examine within three hours. There shall be no blistering, and shall still pass the requirements of test 4.

[a] $I = \frac{B - A}{A}$

where

I is the degree of intumescence;

A is the average coating thickness; and

B is the height of char from substrate.

Annex A (normative)
Type approval

A.1 When the manufacturer is required to prove product conformity to this British Standard, the following shall be provided:

a) test results conforming to this British Standard;

b) wet samples of all materials;

c) a declaration of composition, including the percentage and nature of all ingredients;

d) reference values, if required, e.g. VOC content.

A.2 After type approval has been granted, there shall be no change in the product formulation unless this is approved by the approving authority.

Annex B (normative)
Preparation of test panels

B.1 Preparation of substrate

B.1.1 Where specified (see Table 1 and Table 2) use test panels made from aluminium sheet, conforming to BS L 163 measuring approximately 150 mm × 100 mm × 0.8 mm unless otherwise specified.

B.1.2 Solvent-wash the test panels to remove protective contamination, in accordance with BS EN ISO 1514:1997.

B.1.3 Adequately abrade the test panels, after appropriate cleaning to **B.1.2**, using 120/220-type alumina grit, according to BS EN ISO 1514:1997.

B.2 Intumescent paint application

B.2.1 Prepare the paint by mixing the base and curing agent in the proportions specified and thin as necessary with the appropriate thinners as recommended by the manufacturer.

B.2.2 Apply by spray the mixed paint on the test panels prepared in accordance with **B.1** within 24 h of preparation of panel. Allow to air dry for 15 min minimum.

B.2.3 Apply coats, as in **B.2.2** to produce a total coating thickness in accordance with the manufacturer's instructions.

B.2.4 Allow the coating to air dry in accordance with BS EN 23270 for the time recommended by the manufacturer.

B.2.5 Allow the coating to cure, after the final coat has been applied, before handling in accordance with the manufacturer's instructions.

B.3 Sealing (if or when required)

B.3.1 Seal the intumescent coating after a minimum of 4 h and a maximum of 24 h following application of the final coat of intumescent paint.

B.3.2 Seal the intumescent coating with an appropriate seal coat or appropriate finish coat when required and air cure. Minimum thickness shall be to the manufacturer's instructions.

B.3.3 Allow the coating to cure after the final sealant coat has been applied, before handling in accordance with the manufacturer's instructions.

Annex C (normative)
Test conditions for measurement of thermal conductivity

C.1 Principle

A flame with a temperature of 1 000 °C heats the coated surface of an intumescent coated metal panel. The uncoated side is protected from the heat other than that which is allowed to conduct through the coating and metal panel. The temperature of the uncoated side of the panel is measured after a specified time to indicate if an intumescent effect has sufficiently reduced the conducted heat.

C.2 Apparatus

C.2.1 Test apparatus, consisting of an open topped container, with a 75 mm diameter hole cut in the bottom, with support underneath for the flame from a burner to be able to be directed onto the hole. A thermocouple shall be available to measure the temperature of the flame.

NOTE An example of the type of apparatus is shown in Figure C.1, Figure C.2 and Figure C.3, which are not drawn to scale.

C.3 Specimen

The test panel shall consist of 1.2 mm thick aluminium sheet, conforming to BS L 163, measuring approximately 200 mm × 200 mm and prepared and coated on the one side in accordance with Annex B. A thermocouple shall be attached on the uncoated side.

C.4 Procedure

Secure the specimen over the hole, coating face down. Adjust the temperature of the hottest part of the flame from the burner to (1 000 ± 100) °C. Immediately direct the hottest part of the flame onto the coated side of the panel exposed through the hole in the apparatus. Measure the temperature in the flame and on the uncoated side of the specimen at 1 min intervals for 15 min.

C.5 Results

Record the temperature on the uncoated side of the panel.

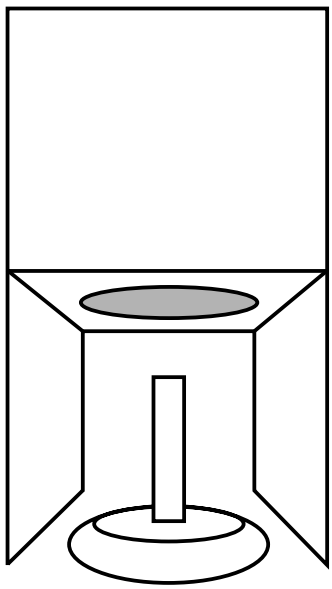


Figure C.1 — Test apparatus viewed from below

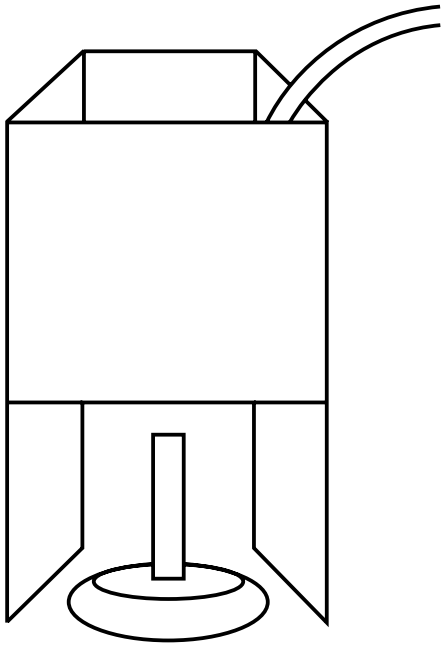
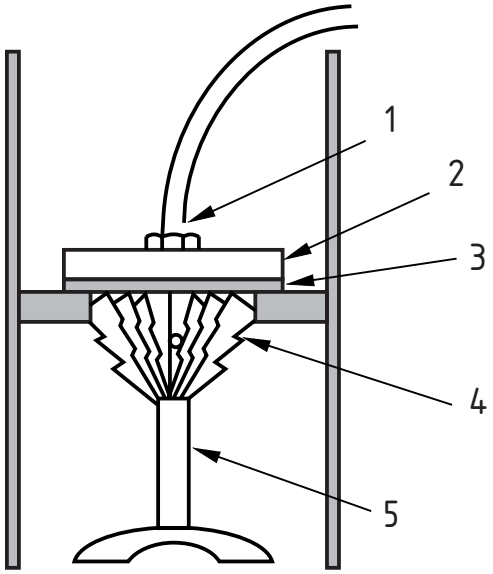


Figure C.2 — Test apparatus viewed from above



Key

1 temperature probe, attached to cool side of specimen
2 aluminium panel
3 intumescent coating
4 flame
5 burner

Figure C.3 — Test apparatus in cross-section

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