

Methods of test for

Paints —

Part E2: Scratch test

NOTE It is recommended that this Part be read in conjunction with BS 3900-0, issued separately.

The European Standard EN ISO 1518:2000 has the status of a British Standard.

ICS 87.040

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Pigments, Paints and Varnishes Standards Policy Committee (PVC/-) to Technical Committee PVC/10, upon which the following bodies were represented:

British Gas plc

Health and Safety Executive

Institute of Metal Finishing

Ministry of Defence

Oil and Colour Chemists' Association

Paint Research Association

Paintmakers' Association of Great Britain Ltd.

Titanium Pigment Manufacturers' Technical Committee

This British Standard, having been prepared under the direction of the Pigments, Paints and Varnishes Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 June 1992

© BSI 03-2001

First published 1966
Second edition June 1969
Third edition June 1992

The following BSI references relate to the work on this standard:
Committee reference STI/10
Draft for comment 87/51645 DC

ISBN 0 580 20914 8

Amendments issued since publication

Amd. No.	Date	Comments
12091	March 2001	Implementation of the European Standard

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
<hr/>	
1 Scope	3
2 Normative references	3
3 Required supplementary information	3
4 Apparatus	3
5 Sampling	4
6 Test panels	4
7 Procedure	5
8 Precision	5
9 Test report	5
<hr/>	
Annex A (normative) Required supplementary information	6
Annex B (informative) Procedure found to be convenient for manufacture and re-tipping of scratch test needles	7
Annex ZA (normative) Normative references to international publications with their relevant European publications	9
<hr/>	
Figure 1 — Scratch apparatus	4
Figure B.1 — Suitable shank for scratch test tip	8
<hr/>	

National foreword

This British Standard is the official English language version of EN ISO 1518:2000. It is identical with ISO 1518:1992.

The UK participation in its preparation was entrusted to Technical Committee STI/10, Test methods for paints, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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, the EN ISO title page, the EN ISO foreword page, pages 1 to 9 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

English version

Paints and varnishes — Scratch test

(ISO 1518:1992)

Peintures et vernis — Essai de rayure
(ISO 1518:1992)

Beschichtungsstoffe — Ritzprüfung
(ISO 1518:1992)

This European Standard was approved by CEN on 18 February 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

The text of the International Standard from Technical Committee ISO/TC 35, Paints and varnishes, of the International Organization for Standardization (ISO) has been taken over as a European Standard by Technical Committee CEN/TC 139, Paints and varnishes, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by September 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

NOTE Normative references to International Standards are listed in Annex ZA (normative).

1 Scope

1.1 This International Standard is one of a series of standards dealing with the sampling and testing of paints, varnishes and related products.

It specifies a test method for determining under defined conditions the resistance of a single coating or a multi-coat system of paint, varnish or related product to penetration by scratching with a hemispherically tipped needle. Penetration of the needle is to the substrate, except in the case of a multi-coat system, where the penetration of the needle may be either to the substrate or to an intermediate coat.

1.2 The method is intended for application as follows:

- a) either as a pass/fail test, by testing with a single specified load applied to the needle to assess compliance with a particular specification;
- b) or by applying increasing loads to the needle to determine the minimum load at which the coating is penetrated.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1512:1991, *Paints and varnishes — Sampling of products in liquid or paste form.*

ISO 1513:—¹⁾, *Paints and varnishes — Examination and preparation of samples for testing.*

ISO 1514:—²⁾, *Paints and varnishes — Standard panels for testing.*

ISO 2808:1991, *Paints and varnishes — Determination of film thickness.*

ISO 3270:1984, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing.*

3 Required supplementary information

For any particular application, the test method specified in this International Standard needs to be completed by supplementary information. The items of supplementary information are given in Annex A.

4 Apparatus

4.1 *Scratch apparatus*, the principle of which is illustrated in Figure 1; other arrangements which give a similar performance can be used, however. This apparatus consists essentially of a horizontally sliding test panel holder (A) driven by a constant-speed motor (B) at a rate of 30 mm/s to 40 mm/s beneath the point of a scratching needle (C), which is perpendicular to the test panel. The needle is fixed in a chuck, directly above which is a holder capable of carrying weights up to a mass of 2 kg. The maximum load for which the apparatus is designed shall be marked on the test apparatus.

The apparatus is adjusted so that the needle comes smoothly into contact with the film, i.e. before the stop (D) reaches the bottom of the sloping ramp, to form a straight scratch not less than 60 mm in length. A ramp with an angle of 10° to 15° to the horizontal has been found to be satisfactory. The panel holder can be designed to allow a lateral movement of test pieces so that more than one scratch test can be carried out on the same test piece.

NOTE 1 Apparatus is now becoming available which will permit a scratch test to be conducted under continuously increasing load.

4.2 *Indicating device*, based on electrical contact between the needle and the metallic substrate to show when the paint film has been penetrated.

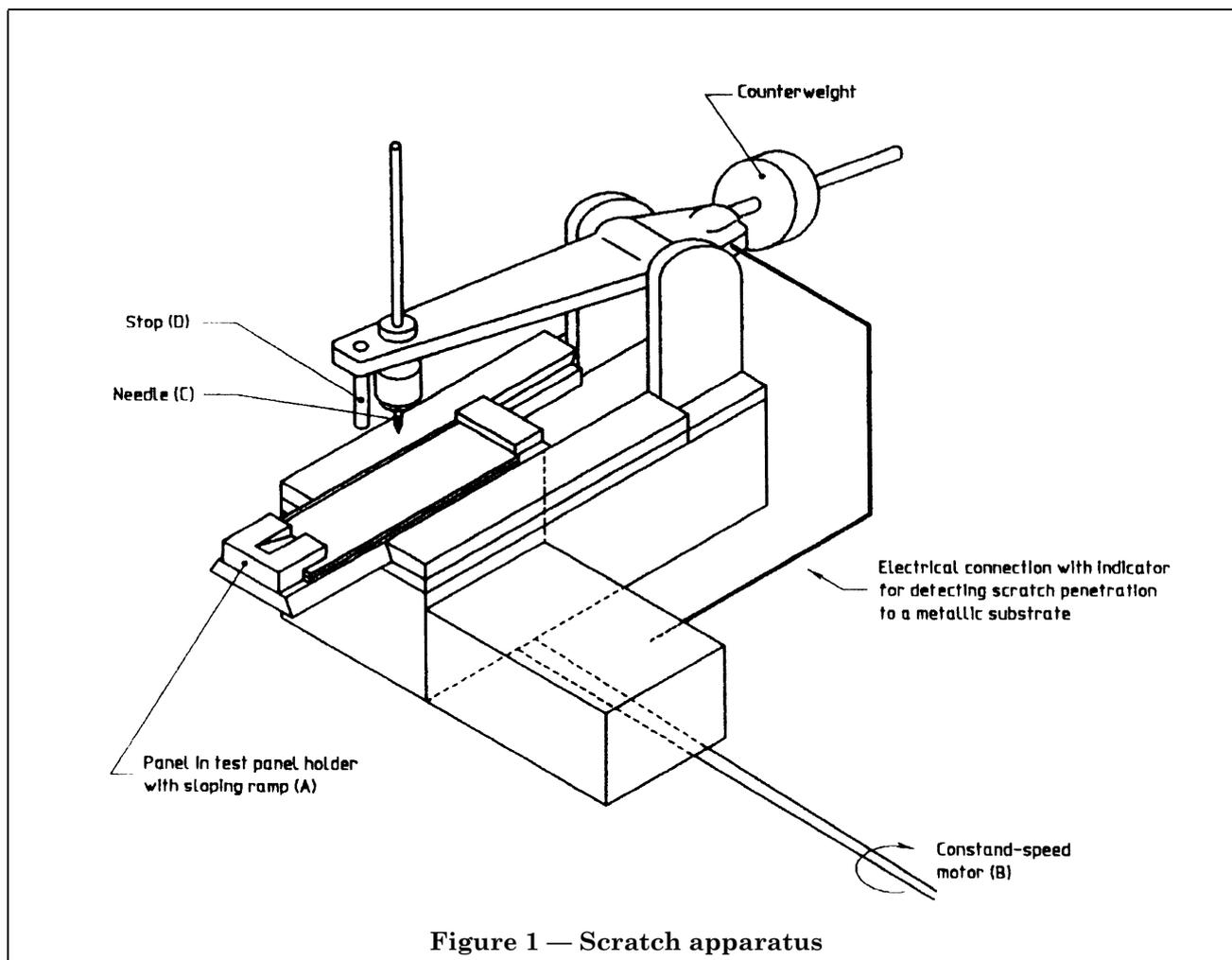
NOTE 2 This device is not suitable for paints containing electrically conducting pigments, or if the substrate is non-metallic, or if penetration to an intermediate non-conducting coat is required.

4.3 *Needle*, having a hard hemispherical tip of 1 mm diameter. The hemispherical tip shall be firmly attached and the exposed part shall be free from any contaminants.

NOTE 3 Details about the tip and the needle are given in Annex B.

¹⁾ To be published. (Revision of ISO 1513:1980)

²⁾ To be published. (Revision of ISO 1514:1984)



5 Sampling

Take a representative sample of the product to be tested (or of each product in the case of a multi-coat system), as described in ISO 1512.

Examine and prepare each sample for testing, as described in ISO 1513.

6 Test panels

6.1 Substrate

Unless otherwise agreed, the substrate shall comply with the requirements of ISO 1514 for burnished tinplate, burnished steel or hard aluminium prepared by acid chromating.

The test panels may be cut to fit the apparatus after coating the substrate and drying, provided no distortion occurs.

6.2 Preparation and coating

Unless otherwise specified, prepare each test panel in accordance with ISO 1514 and then coat it by the specified method with the product or system under test. If the product under test is applied by brushing, any brush marks shall be parallel to the direction of the scratch on the panel.

NOTE 4 Poorer precision is often obtained if the coating has been applied by brush.

6.3 Drying and conditioning

Dry (or stove) and age each coated test panel for the specified time and under the specified conditions. Then condition the coated panels at $(23 \pm 2)^\circ\text{C}$ and a relative humidity of $(50 \pm 5)\%$, unless otherwise agreed (see also ISO 3270), for a minimum period of 16 h. Carry out the test procedure as soon as possible.

6.4 Thickness of coating

Determine the thickness, in micrometres, of the dried coating by one of the procedures specified in ISO 2808.

7 Procedure

7.1 Test conditions

Carry out the test at (23 ± 2) °C and a relative humidity of $(50 \pm 5)\%$, unless otherwise agreed (see also ISO 3270).

Conduct the test on a bench free from vibrations.

7.2 Procedure for a single specified load (“pass/fail” test)

7.2.1 Examine a needle (4.3) under $\times 30$ magnification to check that the hard tip is smooth, hemispherical and free from contamination.

7.2.2 Fix the needle in the chuck so that, when in position on the test panel, the needle will be perpendicular to the panel holder. Balance the needle holder arm by means of the adjustable counterweight. Ensure that the indicating device (4.2), if used, is operational by contacting the needle with the panel holder.

7.2.3 Clamp the test panel, with the coating under test uppermost, to the panel holder of the apparatus, with the longer side of the panel parallel to the direction in which the scratch will be made.

7.2.4 Place weights on the holder above the needle to obtain the specified load.

7.2.5 Start the motor of the apparatus and allow the scratch to be made on the coating. Observe the indicating device during the test, if appropriate, to determine whether electrical contact between the needle and the panel occurs.

7.2.6 Remove the panel and examine the scratch to see if the coating has been penetrated to the extent specified. If, by agreement between the interested parties, the scratch is observed under suitable magnification, state the degree of magnification in the test report.

7.2.7 The sequence of operations shall be carried out three times on each of two test panels. If on none of the six test surfaces the coating has been penetrated beyond the performance required under the specified conditions, report the result as “pass”. If the coating has been penetrated beyond the performance required on one or more of the six test surfaces, report the result as “fail”.

7.3 Procedure for determination of minimum load to cause penetration

Carry out the procedure given in 7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.5 and 7.2.6, using a different part of the test panel for each scratch, starting at a load somewhat less than that expected to cause penetration of the coating and successively increasing the mass on the needle by suitable increments (for example masses of 50 g), until the coating is penetrated. Record the minimum load at which the needle penetrates the coating to the extent specified. Repeat the procedure on a further two panels. Report the lowest result of the three determinations.

8 Precision

The repeatability of results by the “pass/fail” test (7.2) will usually be $\pm 10\%$ of the load.

NOTE 5 The precision of the result is strongly dependent on the (uniformity of the) film thickness of the coating.

9 Test report

The test report shall contain at least the following information:

- a) all details necessary to identify the product tested;
- b) a reference to this International Standard (ISO 1518);
- c) the items of supplementary information referred to in Annex A;
- d) a reference to the international or national standard, product specification or other document supplying the data referred to in c) above;
- e) the results of the test:
 - either, for each determination, whether or not the coating was penetrated under the specified conditions (pass/fail),
 - or the minimum load at which the needle penetrated the coating;
- f) any deviation from the test method specified;
- g) the date(s) of the test.

Annex A (normative) Required supplementary information

The items of supplementary information listed in this annex shall be supplied as appropriate to enable the method to be carried out.

The information required should preferably be agreed between the interested parties and may be derived, in part or totally, from an international or national standard or other document related to the product under test.

- a) Material (including thickness) and surface preparation of the substrate.
- b) Method of application of the test coating to the substrate, including duration and conditions of drying between coats in the case of a multi-coat system.
- c) Duration and conditions of drying (or stoving) the coat, and conditions of ageing, if applicable, before testing.
- d) Thickness, in micrometres, of the dry coating and method of measurement in accordance with ISO 2808, and whether it is a single coating or a multi-coat system.
- e) Temperature and humidity for the test, if different from those specified in 7.1 (see ISO 3270).
- f) Procedure to be carried out (see 1.2).
- g) Specified load to be applied to the needle during the test, if applicable.
- h) Performance required of the test coating in terms of penetration by the needle (see 1.1).

Annex B (informative)

Procedure found to be convenient for manufacture and re-tipping of scratch test needles

B.1 Manufacture of new needles

B.1.1 Fix a batch of shanks in the vertical position with the dimpled end uppermost by inserting them in a tray made from perforated sheet metal.

B.1.2 Place a very small quantity of a suitable solder paste on the end of each shank, and then put a steel ball in position, relying on the solder paste to hold the ball in position at this stage.

NOTE 6 The amount of solder paste to be used is judged by experience; insufficient will not make a firm soldered joint and too much will lead to more or less complete envelopment of the steel ball.

B.1.3 Place the tray of shanks in an oven or muffle furnace adjusted to a temperature of 210 °C to 220 °C for about 5 min to melt the solder and thus secure the ball in the dimple at the end of the shank.

B.1.4 Remove the needles from the source of heat, allow to cool, and wipe each ball to remove flux residues.

B.1.5 Check that the ball is securely fixed and that there is no solder on the part of the ball which will be used to make the scratch.

B.2 Re-tipping of needles

B.2.1 Fix the needles in a tray made from perforated sheet metal as described in **B.1.1** above.

B.2.2 Place the tray of needles in an oven or muffle furnace adjusted to a temperature of 210 °C to 220 °C and, as soon as the solder has softened, remove the tray and brush the end of the needles with a clean brush in order to dislodge the steel balls.

B.2.3 When the shanks have cooled, proceed as described in **B.1.2**, **B.1.3**, **B.1.4** and **B.1.5**.

B.3 Guidance on tip material

The following tips are in common use.

a) Steel balls.

Depending on the circumstances, this type of tip may show signs of early wear. In view of the ease with which needles with steel balls can be made, it is recommended that they be used once only and then re-tipped.

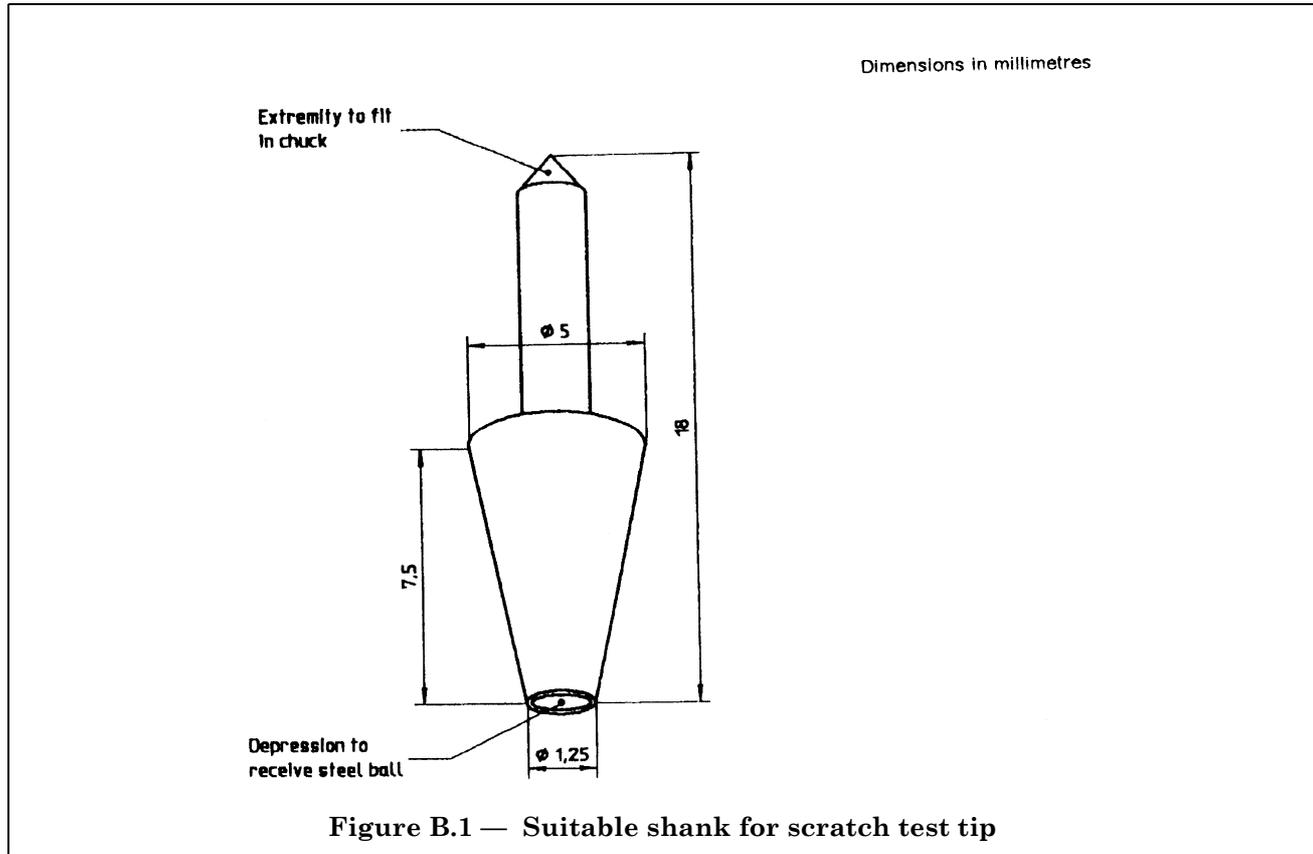
b) Tungsten carbide tips.

These tips last much longer than steel tips and can be obtained commercially.

c) Ruby tips.

These (ceramic) tips last a very long time. The tips have to be attached to the shank by glueing rather than by soldering and can be obtained commercially.

In all cases, it is important that a suitable steel shank is used which will hold the tip securely in the correct position. An example of a suitable shank is given in Figure B.1.



Annex ZA (normative)**Normative references to international publications with their relevant European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

Publication	Year	Title	EN	Year
ISO 2808	1997	<i>Paints and varnishes — Determination of film thickness</i>	EN ISO 2808	1999
ISO 1512	1991	<i>Paints and varnishes — Sampling of products in liquid or paste form</i>	EN 21512	1994
ISO 3270	1984	<i>Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing</i>	EN 23270	1991
ISO 1513	1992	<i>Paints and varnishes — Examination and preparation of samples for testing</i>	EN ISO 1513	1994
ISO 1514	1993	<i>Paints and varnishes — Standard panels for testing</i>	EN ISO 1514	1997

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001. Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001. Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.