BRITISH STANDARD

BS 3900-F5: 1972
[Light fastness]

CONFIRMED
OCTOBER 1991

Methods of test for paints

Part F5: Determination of light fastness of paints for interior use exposed to artificial light sources

It is recommended that this Part be read in conjunction with the general information in the Introduction to BS 3900 issued separately (revised edition published March 1969).

NOTE Part F5 describes a general method which takes into account consideration of DEF-1053, Method No. 33, "Fastness to light".

UDC 667.61 + 667.613:620.191.7

Foreword

This Part of this British Standard describes a procedure for operating laboratory equipment for the determination of light fastness of interior paints. The apparatus is first calibrated by exposure of wool scale pattern No. 4 complying with BS 1006, "Determination of fastness to daylight of coloured textiles. Reference standards". The apparatus thus calibrated may then be used to determine the light fastness of the test specimen.

This Part does not attempt to define either the minimum acceptable standard of light fastness or the precise techniques to be adopted for the test; these are to be the subject of agreement between the purchaser and the vendor. The possible forms which the test requirement as stated in the product specification may take include the following:

1) The test material shall be at least as light fast as a specified wool scale pattern exposed simultaneously.

2) The test material shall be at least as light fast as an agreed paint sample exposed simultaneously.

3) The test material shall show no greater change within a specified period than a previously exposed reference sample.

4) The test material shall not change colour beyond an agreed limit within a specified period. The limit might be defined in terms of a BS or Munsell reference or an agreed reference plate.

5) The test material shall be visually acceptable after a specified period of exposure.

NOTE Of the criteria listed above, 1) and 2) offer the greatest precision, as they take into account any variation in the severity of the test, resulting from the permitted range of fading in the calibration procedure.

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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 6 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.

Amendments issued since publication

Amd. No.	Date	Comments

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Contents

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1 Scope

This Part describes a procedure for assessing the light fastness of interior paints by exposure to light from artificial sources, under prescribed conditions which have been shown to correlate acceptably with exposure to daylight through glass.

2 Supplementary information

The method of test described below should be completed, for any particular application, by the following supplementary information. This information should be derived from the British Standard or other document for the product under test or, where appropriate, should be the subject of agreement between the parties to the test.

1) Nature of substrate.

2) Method of application of test coating to substrate.

3) Thickness of coating and whether it is a single film or a coating system.

4) Duration and conditions of drying and conditioning of coated panel (or conditions of stoving and conditioning if applicable) before testing.

5) Full details of the duration of test for either or both of the specified types of apparatus (see Note to **3.1**).

6) Any particular test requirements (see examples 1) to 5) in the Foreword) and the agreed limit of colour change for the assessment of light fastness.

3 Equipment

3.1 Alternative types of apparatus are permitted, based on either a carbon arc or a xenon arc. A suitable apparatus of each type is described in **3.1.1** and **3.1.2** respectively although other designs may be used provided that they satisfy the requirements of **3.1.3**.

NOTE It has been found that in general when the difference in severity is taken into account the types of apparatus described produce similar effects. For critical application however, users should either satisfy themselves as to the extent of equivalence for the type of material under test or should limit the choice of equipment to a single type.

3.1.1 *Carbon arc apparatus*. This uses as its source of light a 1 600 W d.c. carbon arc[1)] (see Figure 1 for diagram), surrounded by a drum 500 mm in diameter with a suitable rack for holding the test panels. The carbon arc is enclosed in a clear borosilicate glass cylinder of thickness 1.5 mm to 3 mm, 178 mm long and of diameter 127 mm, and is mounted with its axis vertical and in the centre of the drum. The centre of the arc is level with the exposed portion of the test panels.

The arc is formed between two uncored carbons, each 15 mm in diameter, the upper (positive) carbon being approximately 300 mm long when fitted. The power consumption across the arc is 1600 ± 50 W, the voltage being controlled between 130 – 145 V. The burning rate for the positive carbon should not exceed 4 mm/h. A burning rate in excess of this figure can usually be traced to an air leak in the lamp.

NOTE The apparatus should be stopped during each 24 hour period for 1 hour; during this time the glass should be cleaned and the carbons changed.

A cooling fan is mounted beneath the arc. The air temperature in the apparatus shall be 38 – 42 °C when measured by a thermometer adjacent to the test area and shielded from direct radiation.

3.1.2 *Xenon discharge tube apparatus*. This uses filtered radiation from a nominal 1 500 W high pressure xenon discharge tube[2)] (see Figure 2 for diagram).

The xenon tube is positioned vertically, the sample holders being arranged vertically around it. The samples revolve around the lamp at 6 ± 1 rev/min in a circular path so that their axes describe a cylindrical surface and the centres of their faces are normal to incident radiation. At the completion of each revolution, each sample holder is rotated on its axis through 180° so that samples alternately face towards and away from the light source on successive revolutions.

The distance of the sample face from the axis of the lamp is between 75 mm and 80 mm.

The radiation from the lamp is filtered by an inner set of heat-absorbing glasses, and an outer cylinder of borosilicate glass, as recommended by the manufacturer of the xenon tube, to produce radiation which approximates to sunlight behind glass.

[1)] A suitable apparatus is manufactured by J. B. Marr & Co. Ltd., Beacon Lodge, Strawberry Vale, Twickenham, Middlesex.
[2)] A suitable apparatus is supplied by John Godrich, Ludford Mill, Ludlow, Shropshire.

The test chamber and lamp enclosure are ventilated from below by means of a fan, the air passing over the lamp being discharged direct to the exterior atmosphere. The outer glass cylinder is mounted on sealing rings to prevent the cooling air from the lamp reaching the specimens.

The amount of ventilation of the test chamber is controlled, e.g. by an adjustable louvre, so that the air temperature in the test chamber does not exceed 42 °C when measured with a thermometer having its bulb shielded from direct radiation.

As the radiation output of the discharge lamps falls with age, it will be necessary to renew the tube from time to time, probably at intervals of some 1 000 – 1 200 h operation. The precise intervals at which replacement is necessary will be indicated by failure to achieve satisfactory calibration as described in Appendix A.

3.1.3 *Alternative equipment*. By agreement between the purchaser and the vendor, other types of equipment may be employed, provided that the spectral distribution approximates to that of the apparatus described in **3.1.1** or **3.1.2**, that comparable results may be obtained on a suitable range of points and that an appropriate exposure period can be agreed for the purpose of calibration (Appendix A).

3.2 The following items are also required:

1) *Cover sheet*. A sheet of aluminium foil.

2) *Colour matching cabinet*, with a source of artificial daylight complying with BS 950-1 [3].

and for the calibration procedure:

3) *Calibration standard*. A wool scale pattern No. 4 complying with BS 1006[4].

4) *Cardboard*, of thickness approximately 0.5 mm and of rigid quality for mounting the dyed wool calibration standard.

5) *Geometric grey scale*, complying with BS 2662[5].

4 Sampling

A representative sample of the material to be tested shall be taken as described in BS 3900-A1[6]. The sample shall then be examined and prepared for testing as described in BS 3900-A2[7].

5 Preparation and coating of test panel

5.1 Unless otherwise agreed, use a panel of hard aluminium as described in BS 3900-A3[8] and coat it with a pretreatment primer. The dimensions of the panel should be suitable for the apparatus being used but should not in any case be smaller than 60 mm × 40 mm.

5.2 Coat the panel with the material under test by the specified method and allow it to dry or stove in the specified manner and for the specified time. If normal drying conditions are specified these should be interpreted as a temperature of 20 ± 2 °C and a relative humidity of 65 ± 5 % with free circulation of air and not exposed to direct sunlight.

5.3 Condition the panel under the specified conditions for the specified time.

6 Procedure

6.1 Ensure that the apparatus is operating correctly by carrying out the calibration procedure described in Appendix A.

6.2 Cover half the test panel with the cover sheet and expose it in the apparatus for the specified period.

6.3 Remove the cover sheet and compare the degree of colour change with the standard representing the agreed limit of change.

The comparison should be carried out by the method described in BS 3900-D1[9], using the artificial daylight source in the colour matching booth.

The specimens should be placed normal to the source of light and viewed at an angle of 45°.

NOTE It may be appropriate to compare the test specimen with another prepared panel stored in diffused daylight, or a freshly prepared panel.

[3] BS 950, "Artificial daylight for the assessment of colour" Part 1, "Illuminant for colour matching and colour appraisal".
[4] BS 1006, "Determination of fastness to daylight of coloured textiles. Reference standard".
[5] BS 2662, "Grey scale for assessing change in colour".
[6] BS 3900-A1, "Sampling".
[7] BS 3900-A2, "Examination and preparation of samples for testing".
[8] BS 3900-A3, "Standard panels for paint testing".
[9] BS 3900-D1, "Colour comparison".

7 Report of test

The test report shall contain at least the following information:

1) Identification of material under test.

2) The British Standard, product specification or other document setting out the supplementary information required for the test (see **2**).

3) The type of apparatus (carbon arc, xenon tube or alternative) used for the test.

4) Any deviation by agreement or otherwise from the standard test procedure.

5) The result of the test in terms of the stated requirements.

6) Date of test.

Appendix A
Procedure for calibration of test apparatus

A.1 Cut a piece of the calibration standard[10)] to the same size as the test panel and staple it onto a piece of cardboard. Cover half of the calibration standard with the cover sheet.

A.2 Expose the calibration standard in the test apparatus for the following time:

1) For apparatus complying with **3.1.1** or equivalent, 72 h (including the rest periods for changing carbons, etc., i.e. a net radiation time of 69 h).

2) For apparatus complying with **3.1.2** or equivalent, 96 h.

At the end of the exposure period, compare the calibration standard with the geometric grey scale by the method described in BS 3900-D1[11)] using the artificial daylight source in the colour matching cabinet, placed normal to the source of light and viewed at an angle of 45°.

A.3 The apparatus shall be considered satisfactory if the change of colour shown by the calibration standard is equivalent to a degree of contrast of not greater than Grade 2 or less than Grade 3 of the geometric grey scale.

If satisfactory calibration is not achieved, attention should be paid to the operating conditions specified.

NOTE It is recommended that exposure of calibration standards be repeated at 72 h or 96 h intervals, as appropriate, to ensure that the apparatus is functioning correctly, and that calibration is being maintained.

[10)] Wool scale pattern No. 4 complying with BS 1006. "Determination of fastness to daylight of coloured textiles".
[11)] BS 3900-D1, "Colour comparison".

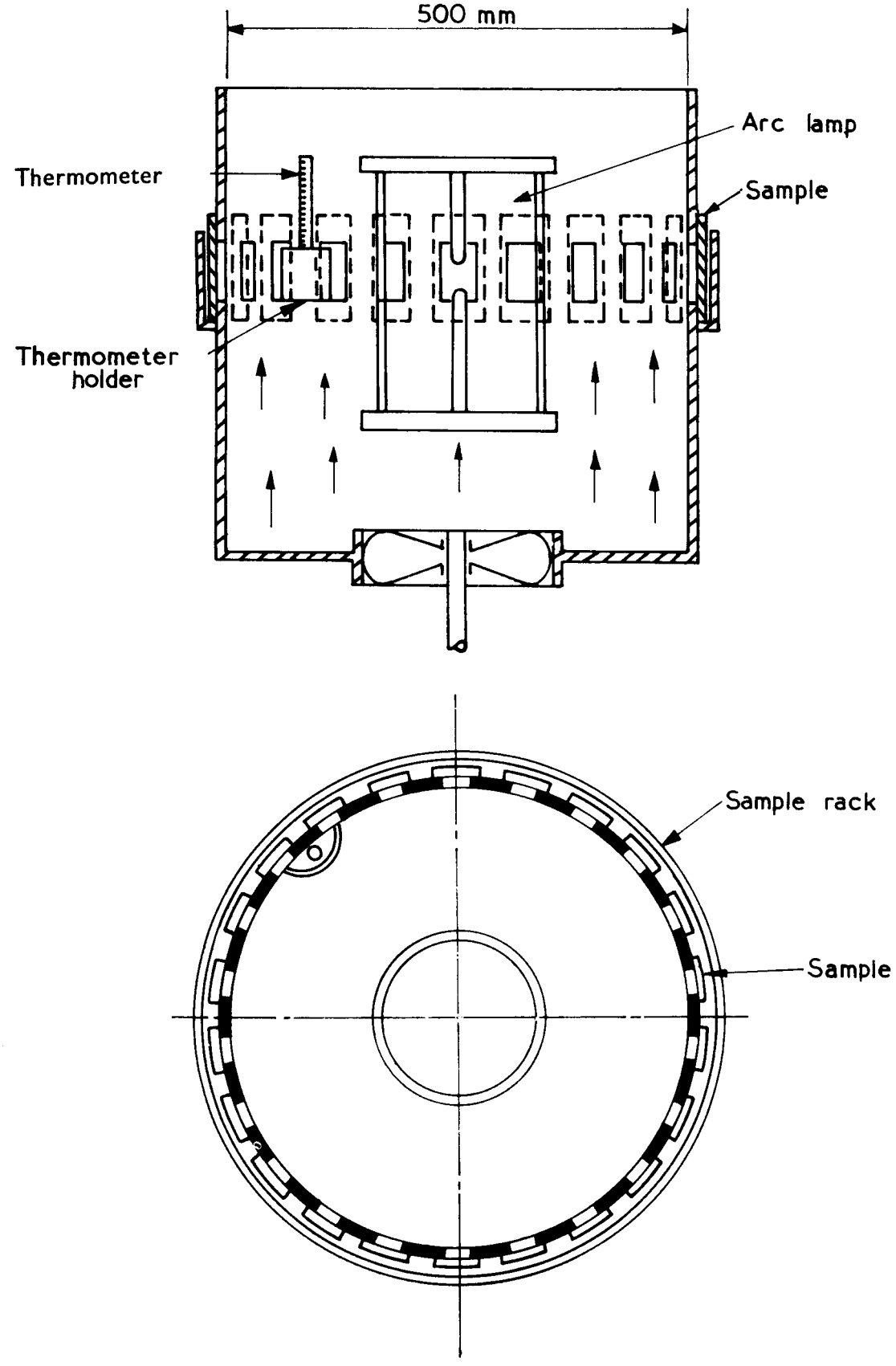

Figure 1 — Light fastness test apparatus using carbon arc

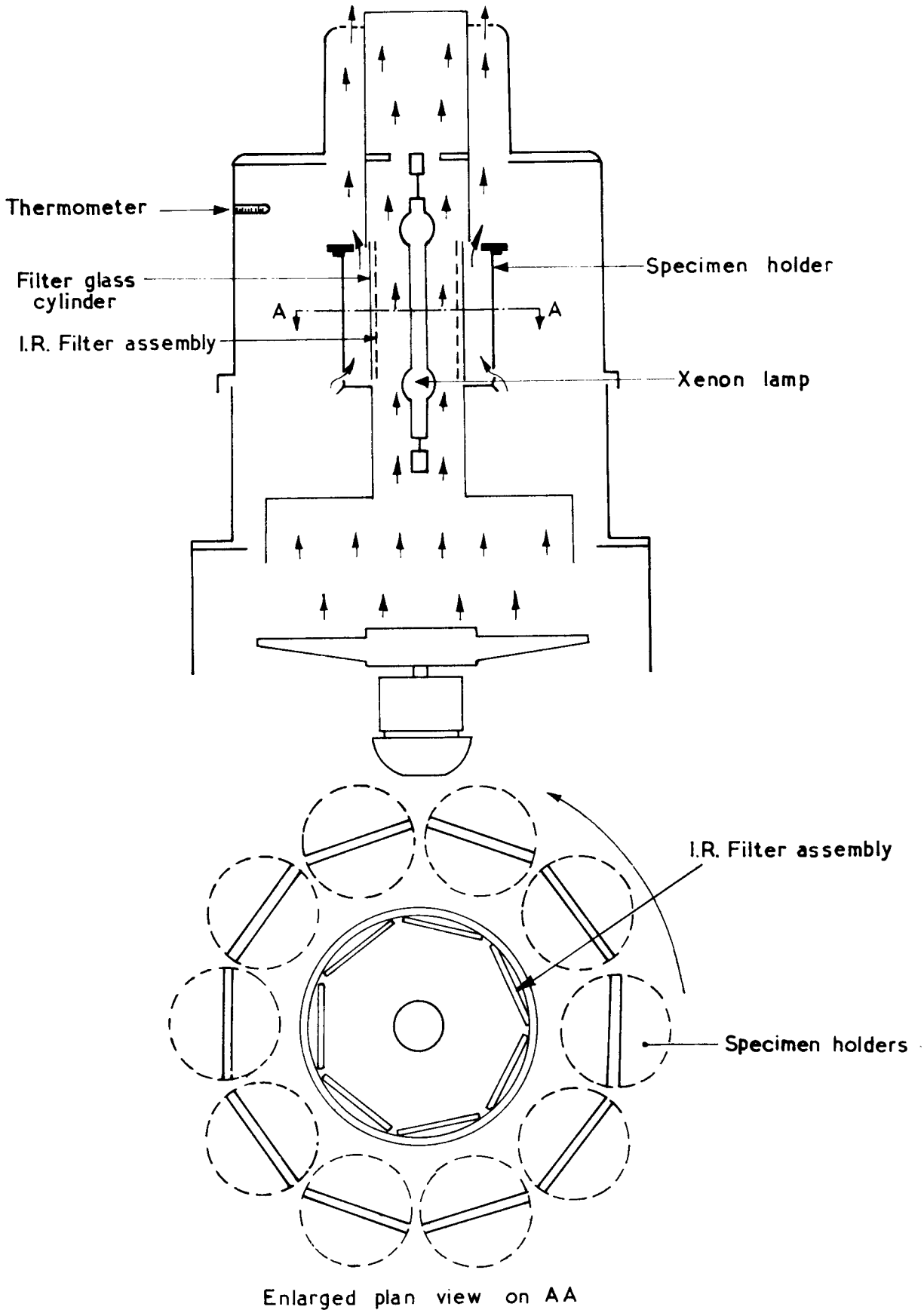

Figure 2 — Light fastness test apparatus using xenon tube

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