BRITISH STANDARD

BS 3900-A5: 1991

# Methods of test for

# Paints —

## Part A5: Large-scale brushing tests for paints and varnishes

Confirmed October 2008

It is recommended that this Part be read in conjunction with the general introduction of BS 3900-0

# 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
Chemical Industries' Association
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 31 May 1991



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# Contents

# Foreword

This Part of BS 3900 has been prepared under the direction of the Pigments, Paints and Varnishes Standards Policy Committee. It is a revision of BS 3900-A5:1968, which is superseded and withdrawn.

The method of test described gives a procedure for applying a paint (top coat, undercoat or primer) or varnish to a substrate and assessing the brushing and flow characteristics. For comparison purposes, a parallel determination is made on a reference paint or varnish with established properties and which is also applied to a substrate representing the end use for which coating material is intended. A selection of substrates is specified.

Before the method can be applied, the product specification or other document making reference to it should detail the substrate and the reference coating material to be used.

NOTE 1 The reference coating material will frequently be chosen by the exchange of an agreed material between the parties concerned and alternative substrates may also be chosen by agreement.
NOTE 2 In this method of test there is a degree of subjectivity relating to the way in which the paint is applied to the test panels by the painter.
NOTE 3 For some coating materials or end uses some additional defects may be critical. Inspection for these should be additionally detailed when this method is to be applied.

There is no international standard corresponding to this method but Technical Committee 35, Paints and Varnishes, of the International Organization for Standardization has prepared a method that has been published as ISO TR 3172:1974.

It has been assumed in the drafting of this standard that it will be used and applied by those who are appropriately qualified and experienced.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, 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 Part of BS 3900 describes a method for assessing the brushing and flow characteristics of paints and varnishes when applied to large areas of closely defined substrates. It can also be used to observe other properties, such as the tendency of the paint or varnish to retract from sharp edges and protuberances, e.g. mouldings, rivet heads, weld seams, etc. with consequent loss of opacity and protective power.

NOTE 1 As an adequate wet edge time is important for brush application to large areas, it is recommended that the wet edge time test in accordance with BS 3900-C1 be carried out in conjunction with this test.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

## 2 Principle

Paint or varnish is applied by brush in a specified manner to a specified substrate with or without mouldings or other protrusions. The brushing and flow characteristics of the paint (top coat, undercoat or primer) or varnish are compared with those of a similar material selected for reference purposes.

## 3 Materials

### 3.1 Reference coating material

A paint or varnish of similar type to the test coating material shall be used for performance comparison purposes (see the foreword).

### 3.2 Test panels

The substrate material shall be chosen to suit the type of paint or varnish under test and its proposed usage. Solvent-borne finishing paints and undercoats shall be tested on filled plywood or primed metal panels; wood primers on unfilled plywood panels; wood varnishes over presealed plywood panels; and waterborne paints on plasterboard or hardboard or for some purposes on unfilled plywood panels. The system used shall be that normally employed in practice, e.g. a finishing paint shall be applied on a primed (or filled) and undercoated panel and an undercoat on a primed or filled panel.

NOTE If, in practice, the paint is to be used on a special substrate or special preparation of the substrate, then the panel used for the test should be chosen and prepared in accordance with these requirements which should be separately detailed.

## 4 Preparation of panels for test

### 4.1 General

Compare paints or varnishes on similarly treated surfaces only.

### 4.2 Wood panels

#### 4.2.1 *Material*

Use birch-faced plywood, complying with type MR of BS 6566-8, measuring not less
than 1.2 m × 0.9 m × 9 mm.

If a moulding is desired, use two strips of moulding. Make up each from two lengths of moulding complying with design S 20 of BS 1186-3, nailed or glued back-to-back as shown in Figure 1. The two strips shall be approximately 1 m long and 0.75 m long. Both shall be mitred at 45° at one end and fitted together to make a right-angled corner. Nail or glue the strips of moulding to the panel so that they are 150 mm from, and parallel to, the edges of the panel (see Figure 2 and Figure 3).

NOTE Alternative wood surfaces to plywood panels may be used by agreement between the interested parties, e.g. half panel door with mouldings.

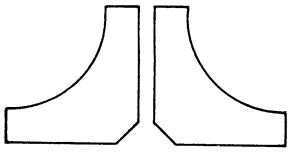

**Figure 1 — Two sections of moulding complying with design S 20 of BS 1186-3**

#### 4.2.2 *Preparation for painting and varnishing*

Rub down the face of the panel and the moulding, if any, with grade No. 0 glass paper complying with BS 871. Rub until a smooth surface is obtained, taking care not to round the sharp edges of the moulding.

If an undercoat or finish only is being tested, the panel may be filled by applying a suitable high-build surfacer to the front of the panel and the moulding. If a wood varnish is being tested, completely seal the panel with at least two sealer coats of a varnish similar to that under test. Allow at least 24 h drying, then rub the panel down with grade No. 0 glass paper complying with BS 871, until a smooth surface is obtained.

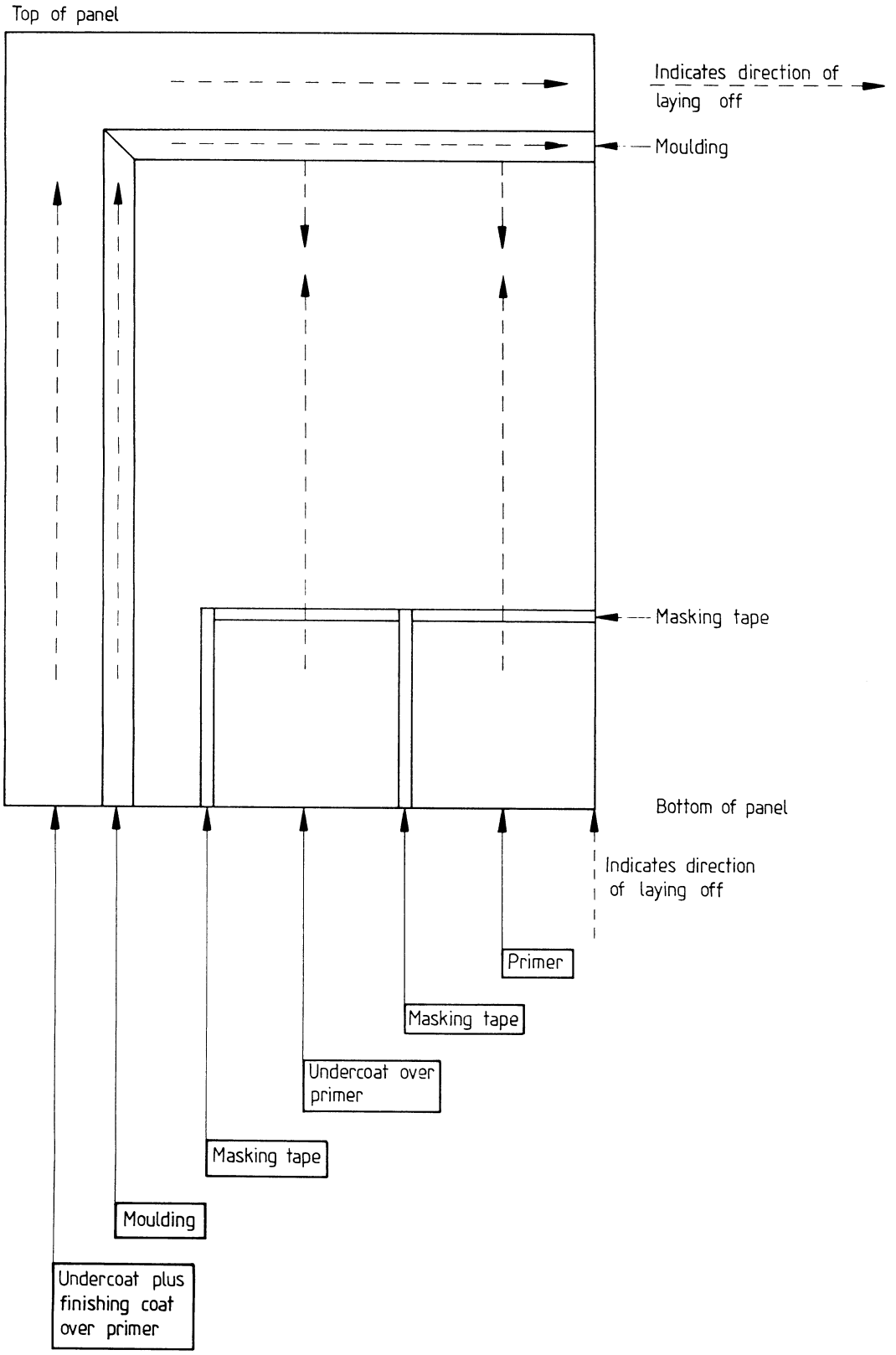


**Figure 2 — Directions of laying off and arrangement of panel prepared in accordance with 5.2.1**

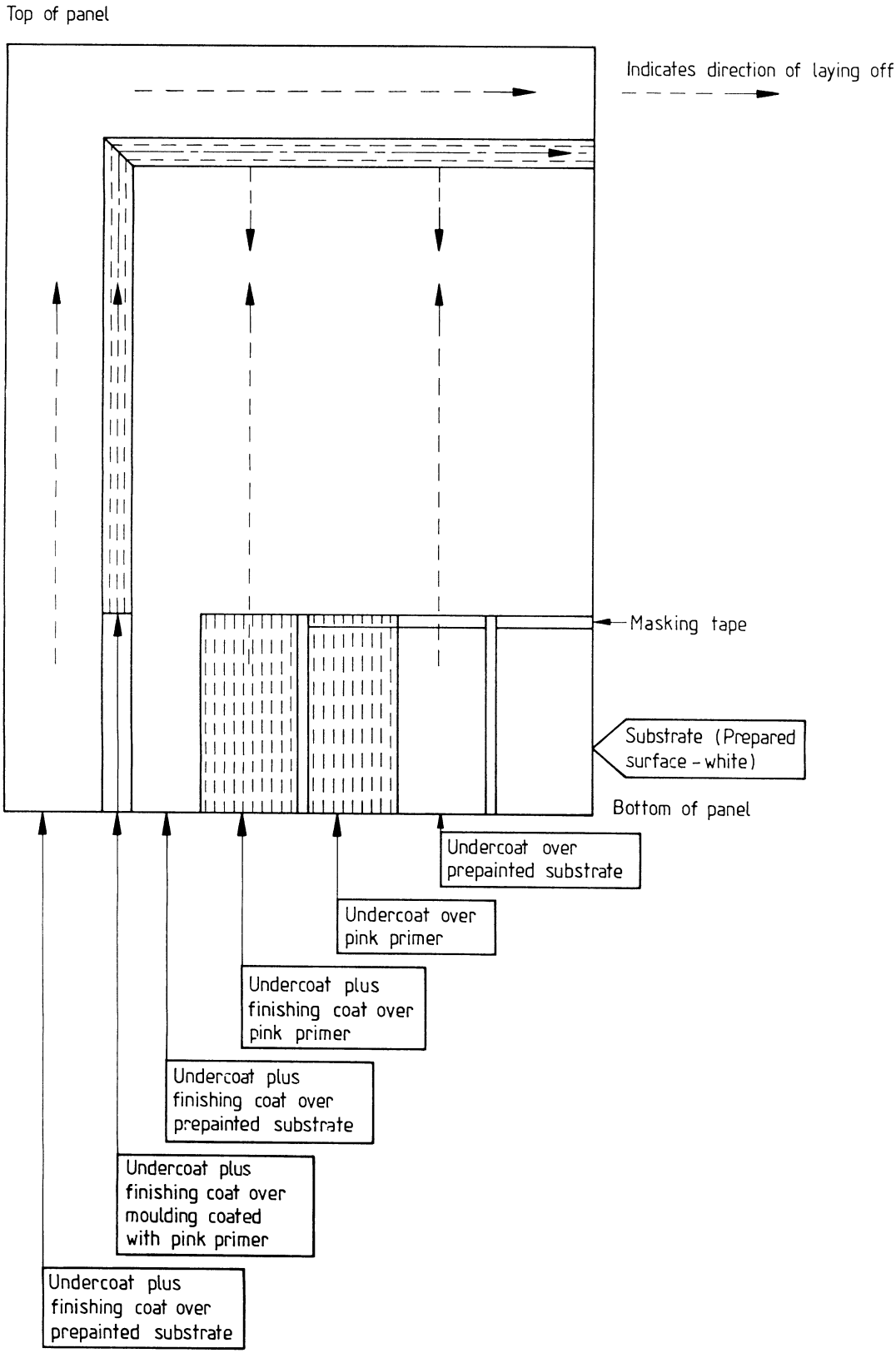


**Figure 3 — Directions of laying off and arrangement of panel in accordance with 5.2.2**

#### 4.2.3 *Reuse of panels*

For testing paint systems other than primers and varnishes, panels from previous tests may be reused provided the surface has been wet abraded until the gloss of the previous test paint has been entirely removed and a smooth surface free from brush marks has been obtained. Use for this purpose silicon carbide paper, C weight, not coarser than grade P 220, complying with BS 871. Renew any mouldings if the sharp edges have become rounded.

NOTE When coated plywood panels are to be wet abraded, it is a useful precaution to coat the back and edges of the panel with one or more coats of a paint to prevent water entering the panel and causing the ply to lift.

### 4.3 Steel panels

#### 4.3.1 *Material*

Use steel sheet of thickness approximately 1.25 mm complying with CR3/FF of BS 1449-1, flattened and oiled and measuring not less than 1.2 m × 0.9 m.

NOTE Plain steel panels only are specified, but in practice, the performance of paints when applied over rivet heads, angle brackets, welds, etc. is important. Special steel panels with rivets, brackets or welds fixed so as to reproduce practical conditions, or portions of metal fabricated structures, may therefore be used, if required, by agreement between the interested parties.

#### 4.3.2 *Preparation for painting*

Prepare the panel in accordance with **3.3** of BS 3900-A3:1986.

NOTE Where, in practice, other methods of preparation are used, for example grit blasting, phosphating or zinc or aluminium spraying, and where it is considered that such preparation may affect the application properties of the paint, the method to be used should be detailed.

#### 4.3.3 *Reuse of steel panels*

Recover plain steel panels in accordance with **4.2.3**. Alternatively, to remove the entire paint coating use a paint remover and prepare the panel in accordance with **4.3.2**.

### 4.4 Plasterboard panels

#### 4.4.1 *Material*

Use gypsum plasterboard complying with type 1 of BS 1230-1 of not less than 1.2 m × 0.9 m × 9 mm dimensions. For painting, use the face designed to receive decoration directly, i.e. the paper-lined face.

#### 4.4.2 *Preparation for painting*

Remove any loose particles from the surface using a dry paint brush and seal cut edges of the panels with an adhesive tape.

### 4.5 Hardboard panels

#### 4.5.1 *Material*

Use the smooth surface of hardboard complying with BS 1142-2 and measuring not less than 1.2 m × 0.9 m × 5 mm.

#### 4.5.2 *Preparation for painting*

Remove any loose particles from the surface using a dry paint brush.

## 5 Procedure for painting and varnishing

### 5.1 General

At the same time as coating panels with the material under test, coat duplicate panels in the same manner with the reference coating material (see **3.1**) so that performances may be compared.

### 5.2 Solvent-borne paints and varnishes

#### 5.2.1 *Testing single paints*

##### 5.2.1.1 *Primers*

Primers shall be tested on panels, according to the function of the primers, prepared in accordance with **4.2.2**, **4.3.2**, **4.4.2** or **4.5.2**, as appropriate. One panel shall be prepared for each primer under test and one panel similarly prepared for the reference primer.

Place one of the panels firmly in a vertical position, e.g. on a rigid stand or frame, with the longer dimension upright. Remove any dust from the surface with a soft lint-free cloth or tack rag. Apply the reference primer to the test surface using a 25 mm or 50 mm brush for the moulding, if any, and a 50 mm or 75 mm brush for the rest of the panel. Use a 75 mm brush on panels without moulding. Lay off the paint in the direction shown in Figure 2. Repeat the procedure with each primer under test using clean brushes identical in type and size with those used for the reference primer. Note any differences in application properties. Allow the primers to dry for 24 h, with the panels in a vertical position.

NOTE Other drying periods may be agreed between the interested parties if thought appropriate.

Compare the primers under test with the reference primer for freedom from brush marking, sagging and flowing away from the edge of dry mouldings, and for any other defects (see note 3 to the foreword).

##### 5.2.1.2 *Undercoats*

Undercoats shall be tested over a primer on plywood or steel panels prepared in accordance with **5.2.1.1**, or on filled or recovered plywood or recovered plain steel panels prepared in accordance with **4.2.2** and **4.2.3** or **4.3.2** and **4.3.3** respectively. Wet abrade each primer (see note to **4.2.3**), using waterproof silicon carbide paper, of C weight and not coarser than grade P 220, complying with BS 871, until similarly smooth surfaces free from brush marking or other defects are obtained on all panels.

Wash the panels thoroughly with clean water, remove surplus water with a soft lint-free cloth or a sponge and washleather, and allow the panels to dry for at least 24 h in a vertical position. Use one panel for each undercoat being tested and one panel similarly for the reference undercoat. Mask off (see note) an area of approximately 0.1 $m^2$ in the form of a square at the bottom corner of each panel, remote from any moulding (see Figure 2).

Apply the reference undercoat and the test undercoat to separate panels as described in **5.2.1.1**. Note any differences in application properties. Allow the undercoat to dry for at least 24 h in a vertical position and then remove the masking.

NOTE The object of masking a portion of the panels is to allow the substrates to be checked for comparability.

Compare the undercoats under test with the reference undercoat, for freedom from brush marking, sagging and flowing away from the edges of any mouldings, and for any other defects (see note 3 to the foreword).

**5.2.1.3** *Finishing paints*

White finishing coats shall be treated as finishing systems in accordance with **5.2.2**.

Finishing paints shall be tested on panels prepared in accordance with **5.2.1.2** except that no part of the primer shall be masked off. The undercoat shall be appropriate to the top coat to be applied.

Before applying the finishing coat, wet abrade and dry the plain areas of the panels in the same manner as described for primers in **5.2.1.2**, except that the silicon carbide paper used for flatting shall be not coarser than grade P 280. Mask off 0.1 $m^2$ of the undercoat at the bottom corner of each panel, remote from any moulding (see Figure 3). Apply the reference finishing paint and the finishing paint under test to separate panels as described in **5.2.1**. Note any differences in application properties. Allow the finishing paints to dry for at least 24 h, with the panels in a vertical position, and then remove the masking. Compare the finishing paint under test with the reference finishing paint for freedom from brush marking, sagging, flowing away from the edges of any mouldings, wrinkling, floating and any other defects (see note 3 to the foreword).

**5.2.1.4** *Wood varnishes*

Finishing varnishes shall be tested on plywood panels prepared by presealing with at least two sealer coats of a varnish similar to that under test. Such presealed plywood panels shall exhibit an even sheen with no “dry” patches.

Before applying the test varnish, wet abrade (flat) the panels using a waterproof silicon carbide paper not coarser than grade P 280. Mask 0.1 $m^2$ of the sealed plywood at the bottom corner of each panel, remote from any moulding. Apply the reference varnish and the varnish under test to separate panels as described in **5.2.1.1**. Note any differences in application properties. Allow the varnishes to dry, with the panels in a vertical position, for at least 24 h and then remove the masking. Compare the varnish under test with the reference varnish for freedom from brush marking, sagging, flowing away from the edges of the mouldings, wrinkling and any other defects (see note 3 to the foreword).

**5.2.2** ***Testing paint and varnish system including white top coats***

**5.2.2.1** Each coat of a paint system shall be applied in accordance with the procedures in **5.2.1**, comparison of application properties being made between the paint under test and the reference paint system at each stage.

Where the wet abrading processes between coats are not recommended in practice, omit these processes from this test. When wet abrasion is omitted, lightly denib the plain areas of the panels, i.e. excluding the mouldings 24 h after the application of the undercoat, using dry silicon paper, grade P 400, complying with BS 871. Wipe over the panels with a tack rag.

**5.2.2.2** When paint systems comprising primer, undercoat and finish including white paints are to be tested, mask off approximately 0.1 $m^2$ of the primer as described in **5.2.1.2**. Then mask off 0.1 $m^2$ of the undercoat along the lower edge the panel adjacent to the masked off primer (see Figure 2). The surfacer used in the preparation new panels (see **4.2.2**) or the recovered surfaces (see **4.2.3**) for testing white paint systems shall white.

On each panel, mask off (see note to **5.2.1.2** and Figure 3) an area of approximately 0.05 $m^2$ in the form of a rectangle 0.3 m in height and 150 mm width at the bottom corner of the panel, remote from the moulding. To provide the necessary contrast before application of the undercoats, coat all of the moulding except for a 0.3 m length, and a patch approximately 0.3 m × 0.3 m, situated at the bottom of the panel with the outer edge parallel to and 0.3 m from the right-hand edge of each panel, with pink primer approximately matching colour 04-C-33 of BS 4800. Air dry for 24 h then wet abrade this coloured patch using silicon carbide paper not coarser than 280 grade, in order to remove excessive brush marks. Allow to dry.

Apply the undercoat and finishing coat in accordance with **5.2.1.2** and **5.2.1.3** except that the area of undercoat to be masked off should be 0.1 $m^2$ at the bottom of the panel adjoining the masked off portion of the substrate, in the form of a square (see Figure 3).

**5.2.2.3** When assessing white systems, pay particular attention to the opacity of the undercoat and the system when viewed either over the primer or over the coloured patch (see **5.2.2.2**) as appropriate.

NOTE The flowing away of white paints from the edges of the moulding can be more easily observed over a coloured moulding.

**5.2.2.4** When assessing varnishes, pay particular attention to the level of gloss attained in comparison with the reference varnish. If required determine the gloss levels in accordance with BS 3900-D5. Use a 20° gloss meter to test very high gloss varnishes. Use a 60° gloss meter to test semi-matt varnishes.

### 5.3 Waterborne paints

Waterborne paints shall be thinned in accordance with manufacturers' instructions and tested on unfilled plywood, plasterboard or hardboard panels, prepared in accordance with **4.2.2**, **4.4.2** and **4.5.2** respectively.

Place one of the panels firmly in a vertical position (see **5.2.1.1**). Using a 75 mm brush, coat the panel with a normal sealing coat of the reference paint. Repeat the procedure on a similarly prepared panel with the paint under test, noting any difference in application properties. With the panels still in a vertical position allow the paints to dry for 24 h (see note).

After drying, mask approximately 0.3 m × 0.3 m on each panel and, using a 75 mm brush, apply a second coat of the paints. Make no attempt to lay off in any one direction. Note any differences in application properties. With the panels in a vertical position allow the second coat to dry for 24 h.

NOTE Other drying periods may be agreed between the interested parties if thought appropriate.

After drying remove the masks from the panels. Compare paints under test, both the sealing coats and the finishing coats, with the reference paints for brush marking, sagging, foaming, cissing and any other defects (see note 3 to the foreword).

## 6 Test report

The test report shall include at least the following information:

a) identification of the paint or varnish tested and of the reference paint or varnish with which it was compared;

b) the number and date of this British Standard,

c) either details of the substrate, paint system and drying times, or a reference to a product specification or equivalent document which includes these details. Particulars of any thinning and the ambient temperature and humidity during the test;

d) an assessment of the brushing properties, for example any brush, drag or tendency to splash;

e) an assessment of the appearance of the dry coating, including a note of any brush marking, sagging, flow away from edges or other defect, for residual foaming and pot marking.

NOTE When appropriate, an assessment of the opacity (see **5.2.2.3**) and determination of gloss (see **5.2.2.4**), should be included.

# Publications referred to

BS 871, *Specification for abrasive papers and cloths.*
BS 1142, *Specification for fibre building boards.*
BS 1142-2, *Medium board, medium density fibreboard (MDF) and hardboard.*
BS 1186, *Timber for and workmanship in joinery.*
BS 1186-3, *Specification for wood trim and its fixing.*
BS 1230, *Gypsum plasterboard.*
BS 1230-1, *Specification for plasterboard excluding materials submitted to secondary operations.*
BS 1449, *Steel plate, sheet and strip.*
BS 1449-1, *Specification for carbon and carbon-manganese plate, sheet and strip.*
BS 3900, *Methods of test for paints.*
BS 3900-A3, *Standard panels for paint testing.*
BS 3900-C1, *Wet edge time.*
BS 3900-D5, *Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85°.*
BS 4800, *Schedule for paint colours for building purposes.*
BS 6566, *Plywood.*
BS 6566-8, *Specification for bond performance of veneer plywood.*
ISO/TR 3172, *Paints and varnishes — Large scale brushing test*[1)].

[1)] Referred to in the foreword only.

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